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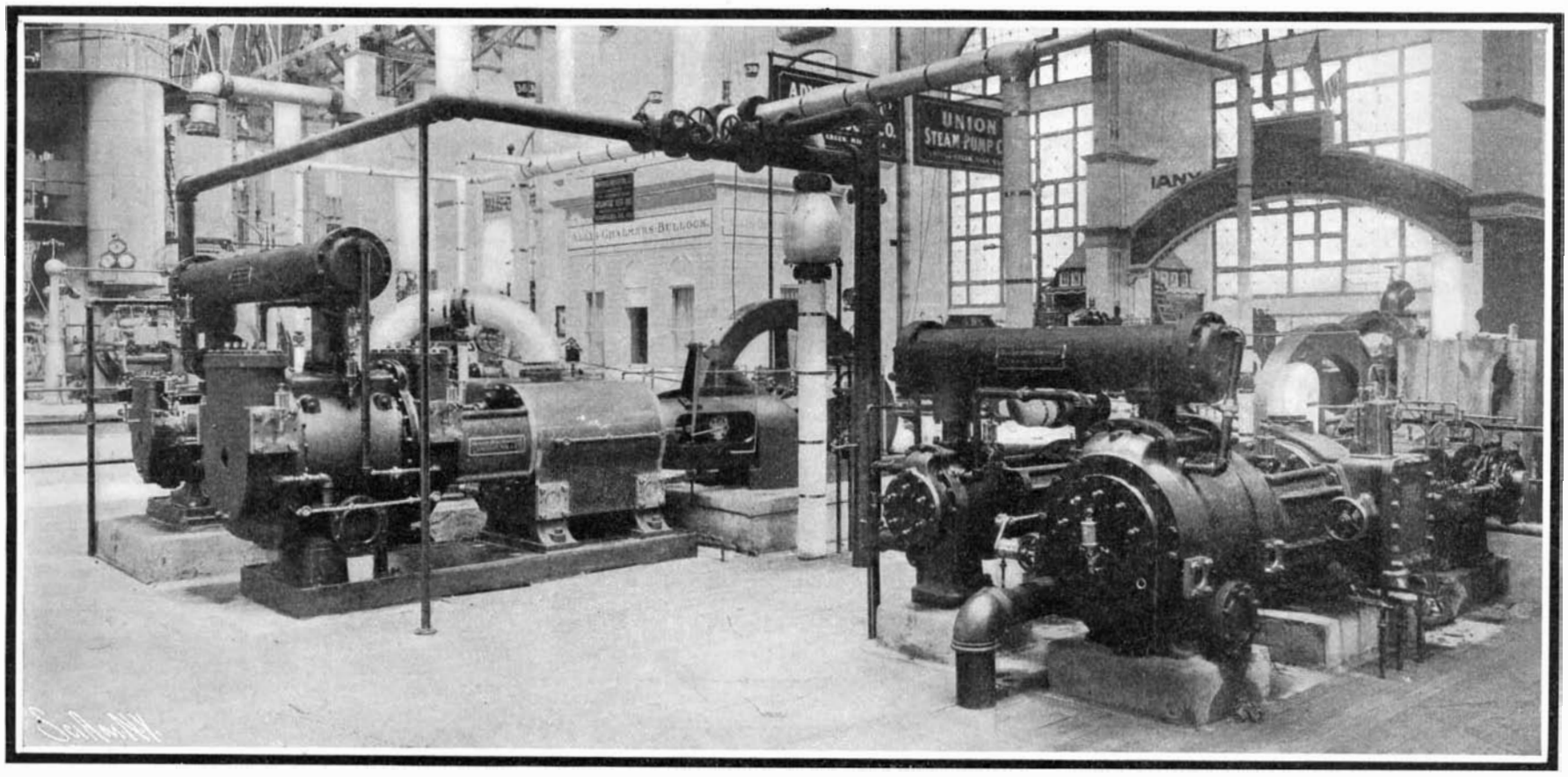

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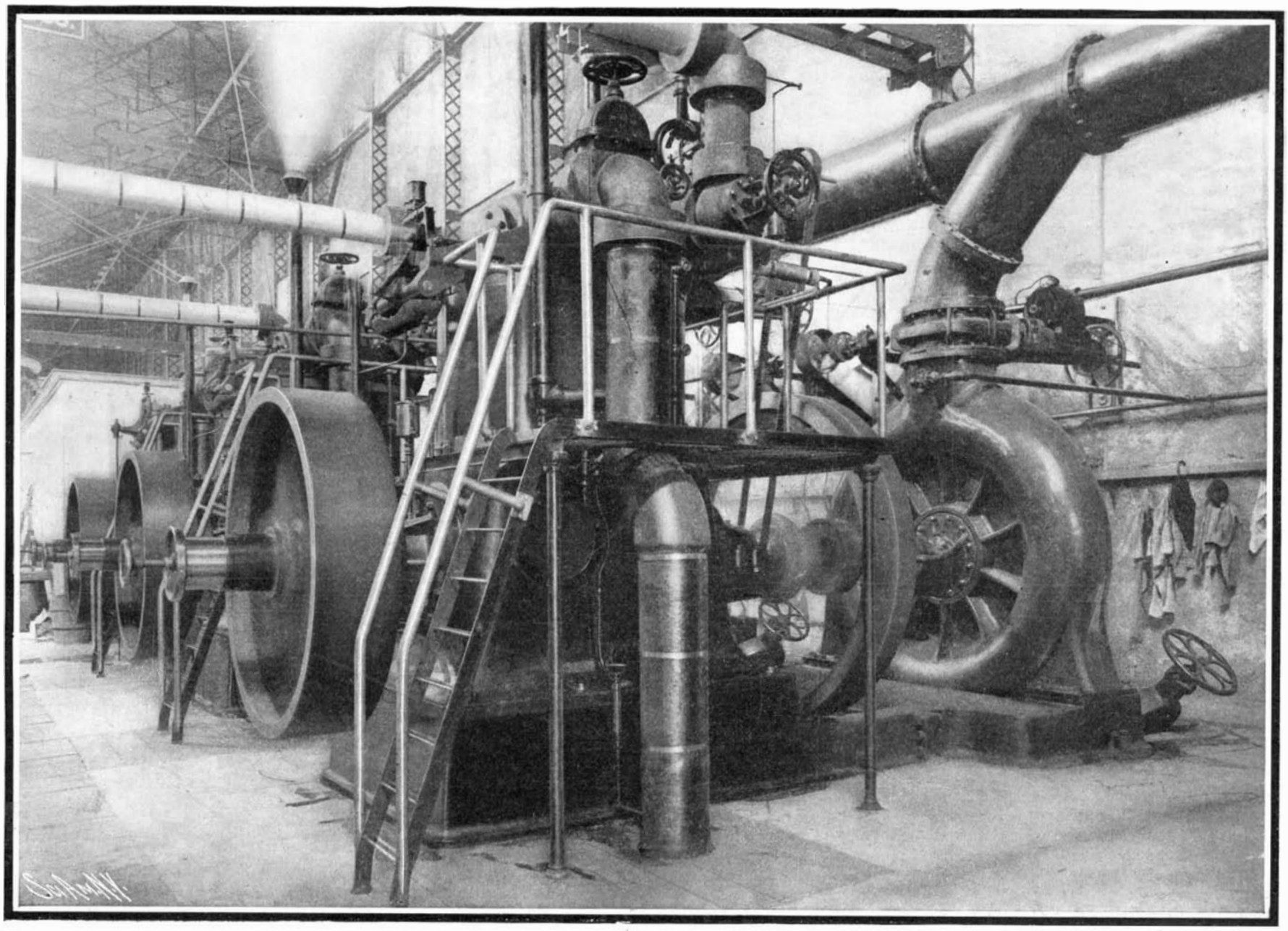

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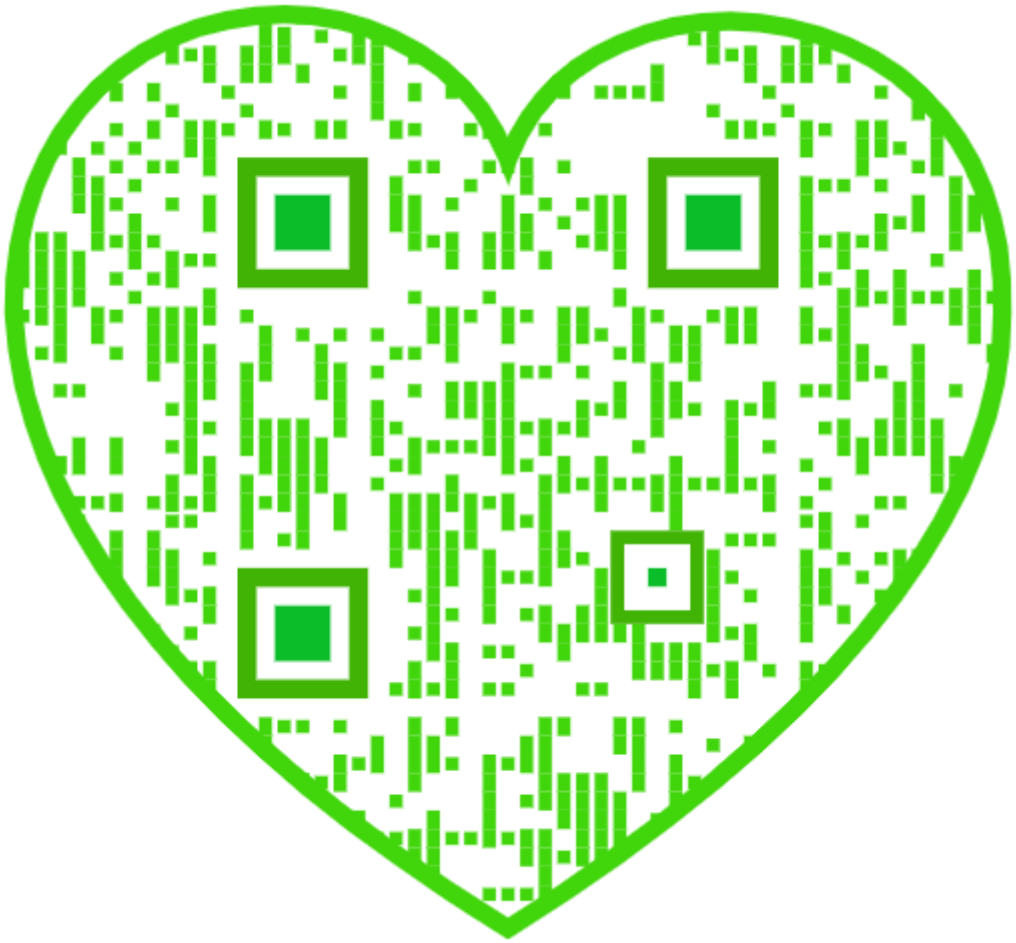

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NEW YORK, SATURDAY, AUGUST 20, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

JAPANESE DARING ON LAND AND CAUTION ON THE SEA.

During the past few months of the struggle in the Far East, there has been a marked difference in the spirit with which the land and sea operations have been carried on by the Japanese. On land they have consisted of a succession of fiery onslaughts and almost reckless sacrifices of men, which is in marked contrast to the extreme caution with which Admiral Togo has handled of late the vessels of his fleet—a caution which is very different from the recklessness with which he sent his ships in under the very guns of Port Arthur in the earlier stages of the war. From the first, the operations of the Japanese army have been distinguished by the daring with which officers and men have made operative the masterful strategy of Gen. Kuroki—a combination of skill and courage that has resulted in an unbroken chain of successes for the Japanese arms. The difference just now between army and naval methods is to be attributed to a change in the conduct of naval operations that dates from the day on which the Japanese lost one of their finest battleships, the "Hatsuse." As we pointed out at the time, the sinking of this vessel by contact with a mine reduced the battleship strength of the Japanese fleet by fully twenty per cent; and this irreparable loss seemed to have brought home most forcibly to Admiral Togo the truth already well known to him, no doubt, that while losses to the army could be made good, and the gaps filled up by willing and brave recruits, losses in the battle line of the Japanese navy were absolutely irreparable so long as the war lasted.

For the wide field of operations, and the extremely difficult character of the work to be accomplished, the navy of Japan was pitifully small. Not only was it necessary to contain the crippled but still powerful fleet of Russia within Port Arthur, but the swift and powerful cruisers at Vladivostock had to be watched, and adequate convoy provided for the troops and supply ships by which the great armies of Japan in Manchuria were to be supplied with recruits, ammunition, and food-stuffs. These duties would task the resources of a fleet much larger than that of Japan; and when back of this there loomed the possibility of a second Russian fleet, embodying five of the newest and most approved pattern of battleships, arriving in eastern waters, for co-operation with the Port Arthur squadron, the task might well have daunted a greater maritime nation than Japan. Not only must Admiral Togo sink or destroy the eastern fleet of Russia; but he must do so, if possible, without the loss of a single battleship or armored cruiser; for should the Japanese admiral have to face the freshly-arrived Baltic fleet with two or three of his battleships sunk and the rest of his fleet heavily crippled, the command of the sea, as far as human foresight could forecast events, would pass to Russia, and the capitulation of the Japanese armies in Manchuria, cut off from their base of supplies, would be but a matter of time. It is considerations such as these, no doubt, that have caused the Japanese admiral to conduct his operations at longer ranges than he did in the earlier stages of the war. He has been content to hold the Port Arthur fleet of Russia securely within the harbor. Even when sorties have been made, it has seemed as though he preferred to fight long-range engagements rather than place himself within reach of the submerged torpedo tube or the ram of Russian battleships. Admiral Togo has a double task to perform. He must not only sink the enemy's ships, but he must do so and come out of the fight with his own vessels afloat and, as far as may be, intact. Should he steam into close quarters and succeed in sinking the six battleships of Russia at the cost of the loss of three of his own, the ultimate failure of Japanese arms on land and sea would be rendered all but certain by that victory; for with but two battleships afloat, the command of the sea would pass immediately to the powerful Baltic fleet upon its arrival in the Far East. Admiral Togo does not forget that this reserve fleet will include, as we have said, five of the most effective battleships ever built for a naval power.

The question is frequently being asked as to why the Japanese, with their evident superiority in seamanship and gunnery, do not close in and finish the Russian fleet at the first opportunity. The answer is to be found in the considerations which we have discussed above. The destruction of the Russian fleet, if Japanese strategy and tactics can have their way, will be accomplished either by long-range gun fire, or by torpedo-boat destroyer attack. Exact details of the results of the recent sortie of the Russian fleet from Port Arthur are not available at the time we go to press; but it is likely that in spite of the general engagement which is reported to have occurred, few, if any, of the Russian ships have been sunk, and what damage they sustained has been entirely from Japanese gun fire. It is the same necessity of fighting with a view to as little disablement to his fleet as possible, that has caused Admiral Togo to leave the Vladivostock squadron to an unmolested raiding of the high seas. It would be futile and disastrous to send his protected cruisers against the armored ships from Vladivostock, and Togo can ill spare any of his own armored cruisers from the important work of containing the Russian fleet within Port Arthur and destroying it, should it come out.

RADIO-ACTIVITY INDUCED BY THE EMANATIONS OF INCANDESCENT METAL WIRES.

In a paper recently read before the French Academy of Sciences, Mr. T. Tommasina records some recent experiments made by himself on monopolar electric dispersion, produced by a metal wire heated to redness by the electric current and placed either in parallel with the vertical disk of an electroscope or between two plates of a condenser, one terminal of which is connected with the ground and the other with the electroscope.

The discharging effect, according to Tommasina, is not necessarily unilateral, as had hitherto been supposed. On the contrary, even with the lowest active temperatures any metal is found to act on both electricities, though there is a considerable difference between the two effects. This difference depends on the sign of the charge, increasing as the current continues to pass in the case of metals and producing a more rapid decay of negative charges, as for instance iron and copper. On the other hand, this difference is found to decrease with metals for which the maximum activity has an opposite sign, as for instance silver and zinc.

A zinc-plated iron wire, after producing for some time a more rapid decay of positive charges, will gradually show smaller differences, until both effects become equal, when a difference in the opposite direction begins to manifest itself, the decay becoming finally the same as that of pure iron, as the zinc has entirely disappeared.

The difference between the two decays as characteristic of the various metals will gradually decrease for augmenting current intensities. In fact, with a very strong incandescence or a partial melting of the wire, the two decays will become practically equivalent, while the radio-activity assumes the maximum value. If the wire be cut the explosive discharge passing at the rupture will result in the same decay, no matter whether the electroscope be charged positively or negatively, and regardless of the nature of the metal wire. Hence it is inferred that these results are not due to ultra-violet rays, which, as is well known, produce immediately only the discharge of polished negatively electrified metals.

The radio-activity of any metal wires heated to redness by the electric current will decrease according to an asymptotical curve. It is merely necessary to rub the wire slightly between two fingers, or else to leave it to itself for some time, to restore its maximum activity. In the case of platinum, the maximum decay of which is observed with negative charges, a similar fall of the radio-activity is observed, while only the positive decay seems to show a decrease with time.

If the radio-activity of the wire has become very small, the wire is found to remain radio-active for a long time when the circuit is broken. This phenomenon is made to disappear nearly completely by rubbing the wire, or else spontaneously after an interval varying according to the nature of the wire and the duration and intensity of the current used. If the wire be surrounded by a jacket of glass or aluminium (the latter being grounded) the cover will assume a radio-activity of its own.

These phenomena must necessarily be due to a radio-activity induced by the emanation of the incandescent wires. Tommasina has made further investigation in this direction, in the course of which he has stated the presence and studied the action of the typical alpha, beta, and gamma radiations.

The alpha radiation is arrested by any, even the thinnest, screen while seeming to diffuse in the open air with a very marked tendency to following the electric flux, and always bearing a positive charge.

The beta radiation will traverse very thin paper and aluminium screens, which absorb a large portion of it, and become negatively electrified.

The "pyro-rays" will produce a strong ionization of the air, resulting always in the same discharge, independently of the charge of the electroscope. Although capable of penetrating an hermetically closed pasteboard box, they will undergo a strong damping effect. On barium-platinum-cyanide screens they will induce a fluorescence, though of very low intensity. The gamma rays are given off in greatest amounts from incandescent platinum wires and from explosive discharges between any metal wires.

DEDUCTIONS FROM THE BALTIMORE FIRE.

In adjusting the losses made by the great Baltimore fire, the various insurance companies interested were enabled to analyze the efficiency of material used in the so-called fireproof buildings and the manner in which they were constructed. The disaster afforded the best opportunity which has yet been given to study the effect of a conflagration upon modern structures intended to resist the action of heat, and experts were employed who have made a very exhaustive investigation covering a period of several months. This investigation was in connection with the appraisal of damages, and, as a result, statistics are available which show percentages of loss that may be considered approximately accurate. In previous articles a description of the principal office buildings which were in the burned area has been given, and in articles published immediately after the conflagration statements were made to the effect that brick and terra cotta were far better for resisting heat than any kind of natural stone. These conclusions are borne out in the several reports of the experts referred to.

For the purpose of comparing the percentage of loss on different materials, three of the larger office buildings have been selected from the eight structures which were reported on—the Continental, the Equitable building, and the Maryland building. The Continental was considered the best constructed of the series, comprising sixteen stories and a basement. It was somewhat isolated from the others, and, owing to its height was more exposed to the action of the fire. The Equitable was but ten stories high and protected on two sides, including the direction from which the fire approached, by other structures. The Maryland, which was ten stories high, had practically no protection on one side and on the rear from the flames. The three buildings contained every kind of supposed fireproof material utilized in Baltimore, and in estimating the percentages of damage the experts calculated upon the value of the different substances as they were left in the burned structures, allowing for all which could be utilized in making repairs. The following table shows comparative percentages of loss:

	Equitable	Continental	Maryland
Masonry	51	49	58
Granite	61	58 total (cut stone)	
External marble..	64	—	—
Steel	43	9	6
Ornamental iron ..	62	77	21
Fireproofing	94	54	76
Internal marble ..	90	94	total
Terra cotta	69	73	76

In the above calculations the examiners considered all brickwork in the Equitable Building under the head of masonry. With the steelwork was included the cast-iron columns and other portions of the frame which are noted hereafter. The ironwork in all the buildings classed under the head of ornamental, refers to staircases, railings, etc. In the Continental Building, the brickwork is also classified under the head of masonry, while the marble was exclusively for interior decoration. The cut stone referred to in the Maryland Building was also for exterior use, while all of the marble work was utilized for interior finish.

In planning the Continental Building, the first three stories were veneered with granite and reinforced with brick. Above, they were of ordinary and pressed brick with terra-cotta trimmings, the pressed brick being anchored to the common brick with strips of galvanized iron. All of the steel was covered with fireproofing throughout, except a portion of the roof girders. The marble was used principally in wainscoting and in the halls, corridors and on the floors. The marble work cost $108,000, which will give an idea of the great loss which was sustained in this material alone. The galvanized-iron strips between the brickwork gave way, allowing much of the brickwork to fall out. Had it been set more firmly and reinforced with brick the terra cotta would have sustained less loss. The experts considered that the partitions and wall tiling in the building were too light for the purpose and poorly constructed, which accounted for their total loss. They attributed the small percentage of damage to the steelwork to the fireproof covering. The offices in this building were equipped with vaults built into the walls. In quite a number, the contents of the vaults were destroyed, and it was decided that nearly all of the doors must be replaced.

The Equitable Building was of the "cage" formation, the columns being of cast-iron bolted together with cast-iron lugs to receive the girders, which were of 20-inch steel. The beams used in the framework were of light 9-inch steel bolted to the girders at right angles with spaces of about 8 feet apart. The framework formed a structure by itself independent of the walls, while the walls of the outside area and rear were also independent, resting on their own foundations. The three lower stories of the building were faced with granite, pressed brick being used above the third story with terra-cotta trimmings and granite sills. The rear and area walls were faced with the enameled brick with granite sills. The cornices were also terra cotta and covered with a marble coping. The four arches were of 6-inch hollow tile and the partitions were made of what is known as limeotile, as well as the ceiling under the roof. The experts are of the opinion that the percentage of masonry loss was caused largely by the facing of glazed brick used in the area and light shaft. The damage to the granite was partly due to the construction of a number of bay windows of wood on the lower portion of the exterior. All of the so-called fireproof material was a total loss where reached by the heat. Office vaults were also set into the walls of this building. The total damage to these is estimated at 73 per cent, many of them being wrecked because the floors were too weak to support their weight after the building had been fire-swept, and they fell through to the cellar, causing considerable damage to the structural steel.

The Equitable Building was one of the first supposed fireproof structures to be erected in Baltimore, and the Calvert, which adjoined it, among the last. The steel framework of the latter building was faced on the outside with common brick, and it is due to this fact that the percentage of damage to the steel erection was but 1 1-3 per cent. The loss on ornamental ironwork was 37 per cent, common brick 5½ per cent, enameled brick 7 per cent, and terra cotta 74 per cent. Here, as in the Equitable Building, the partitions were a total loss. The damage to the terra cotta was largely due to the manner in which it was set, according to the appraisers.

As a result of the examination of the Equitable Building, the conclusion was reached that the total loss upon it would have been but 50 per cent had more care been taken in its construction. The principal criticisms were that the floor beams were too light and spaced too far apart considering the weight they had to sustain. The fireproofing was not properly cemented. In the case of the Continental Building much of the loss is also attributed to faulty construction of the same character. The reports relative to the Continental and Equitable buildings are cited because the statements they contain apply to nearly all of the other structures which were appraised. In determining the heat-resisting qualities of the various materials, the experts placed brick first, then terra cotta, with porous tile third. The material known as limeotile was a total loss. Granite and marble were most seriously affected by the contact with heat, while structural steel, where properly fireproofed, demonstrated its thorough efficiency.

The examiners claim that much damage had been caused in many instances by the work of the gas fitter, the plumber, and the electrician. In nearly every building fireproof material had been removed to place wires and pipes and had been replaced so loosely that openings were left where the structural metal was exposed. With the temperature ranging from 1,900 to 2,500 deg., every part of the exposed metal was affected, while many instances were found where the heat had apparently separated the covering from the iron and steel by causing the metal to expand where it reached its surface. A number of the buildings had been erected by dividing the contracts among several builders in order to save time. For example, one company would complete the stone and brick work, another the woodwork, and another the electrical work and plumbing. Consequently after the framework had been finished and fireproofed it was often damaged by the carelessness of employees of other contractors who removed portions which had been done without replacing it properly.

It is only reasonable to suppose that the Baltimore office structures contained as good material and were built with as much care as the average buildings intended for the same purpose in other cities. Consequently the criticism which applies to them will apply to many of those in the metropolis and elsewhere, and in case of being fireswept under similar conditions the percentage of loss would probably average as much. Therefore it is interesting to note the total loss percentage on the "fireproof" group, estimated on their value just prior to the fire and as the appraisers found each. The percentages follow: Continental, 65; Equitable, 74; Merchants' Bank, 54; Calvert, 58; Union Trust, 61; Herald, 59; Maryland Trust, 60.

It will be noted that in every instance over 50 per cent of the original value was destroyed, the average loss per cent for the entire number being 61 4-7. The Equitable, which sustained the greatest damage, was, as already stated, framed partly of cast iron, which accounts for a large part of the percentage. The Continental suffered by reason of its location as well as light construction. The Merchants' Bank, which has the smallest percentage, was one of the lowest structures, had buildings directly adjoining it in the direction from which the fire came, and had very thick exterior walls, faced entirely with granite, but which was heavily reinforced with brick.

ELECTRICITY IN AGRICULTURE.

At a recent meeting of the Belgian Society of Engineers and Manufacturers, E. Guarini delivered a lecture upon the present state of the agricultural applications of electricity. After recalling the fact that certain applications of this kind are now old, he said that it was a pleasure to note that a return was now in progress, a return proved by the number of installations that have recently been made in different countries. This is due to the increasing needs of our civilization and to the incontrovertible fact that savings and other advantages have been realized in the industries into which electricity has entered. What will most contribute toward a still further extension of the applications of electricity will be the creation of great central stations for the cheap distribution of energy to farms. Countries which have extensive deposits of coal are well situated for the distribution of electricity and have no reason to envy countries such as Sweden and Italy that are rich in water power. After asserting that the energy of coal mines really costs half as much when it is transmitted electrically, the lecturer set forth the great advantage that would result to central stations that should find a sufficient daily demand for agricultural applications. Electricity may, on the other hand, be produced upon the farm itself for a single exploitation or for a group. For this purpose, steam engines, gas, gasoline, wind, or sun motors may be employed, according to circumstances.

The current best adapted for the farm is the continuous one, because it permits of certain applications for which the alternating current is not adapted. When the current is produced at a great distance, the best thing to do is to transmit it in a high tension alternating form and convert it into a low tension continuous current on the farm itself.

The applications to the farm, in order to permit of a greater efficiency being attained by the central station and a larger revenue being obtained from the capital invested in it, should be numerous.

For tilling, the plow is placed by preference on the two opposite sides of the field and is drawn first in one direction and then in the other. The motors for the machines are by preference portable, so that they can be placed alongside of the one to be actuated, such for example as a thresher, straw cutter, carrot or beet chopper, pump, mill, shearing machine, churn, skimmer, separator, etc. Dr. Oldenbourg has found that electric churning permits of effecting a saving of 70 centimes (14 cents) per quintal (220 pounds) in comparison with the cost of the work done by hand.

Purification of water by electrolysis with an iron positive (the organic matters being precipitated by oxide of iron); bleaching of oils and fats by electrolysis after the addition of salt water; purification of saccharine juices by electrolysis, more or less complicated, or by ozonization, are a few of the chemical applications.

Luminous applications are electric lighting of the farm and electric lighting of the fields for night work.

Among the calorific applications may be mentioned the De Mare hot-air fan; electric culinary apparatus and incubators; carbonization of peat by electricity in order to convert it into a full equivalent to 50 per cent of coal, in 10 or 20 minutes instead of several hours; the Herrgott electric coverings and clothing representing the most economical electric heating.

Thirty thousandths of an ampere at 500 volts would kill a man. Insects may be killed in the ground or upon trees by electrifying the surroundings if the current that passes through the insect is sufficient. By this process it is possible to sterilize water and milk. M. Guarini stated that in collaboration with Dr. Samarini, he had succeeded, after numerous experiments, in practically sterilizing milk, and explained why the experiments made in the same direction by his predecessors had failed.

The telegraphic connection of farms with one another and the market is rendered possible. The district of Oceana embraces villages that are connected with the market of Hart by a telephone line 40 miles in length. The telephone and wireless telegraphy present many advantages for the country. Wireless telegraphy is already employed for the simultaneous firing of cannons for breaking up hail storms and also for producing artificial clouds.

It is important for the farmer to consult meteorological apparatus in order that he may know how to conduct his agricultural operations. The Luncotta pluviometer informs him as to the frequency, importance and nature of rains, and the various electrographs allow him to keep himself posted as to the movement, approach, and extent of storms, and to take precautions in consequence.

A PLEA FOR THE ENDOWMENT OF ASTRONOMICAL RESEARCH.

In April, 1903, Prof. Edward C. Pickering, of Harvard University, published a pamphlet showing how a large sum of money could be expended each year for extending astronomical research. It was stated that much better results could be obtained by co-operation and in general by improving the present quality and quantity of work done. It was further proposed that the fund should be administered by a committee of astronomers and that Harvard should act as a trustee of the fund. At the same time a circular of inquiry was sent to the members of the various astronomical and scientific societies. It is believed that few astronomers widely interested in the progress of science, whose opinion would be of much value were thus omitted. Five questions bearing on the subject were contained in the circular. In a second pamphlet, published last month and intended to supplement the first, Dr. Pickering gives a resumé of the first publication and comments on the replies to the five questions contained in the circular. He does not discuss the replies to the first three as it is believed that the writers would prefer a postponement of such action, until the establishment of a fund would enable a part at least of the proposed work to be undertaken. These questions are: How do you think money could be spent most advantageously on astronomy at the present time? Can you recommend any definite plan, in form for presentation to a possible donor? In what way could money be most usefully expended at your Observatory or under your direction? Few definite answers to the second were given, but, doubtless, if a large sum of money were already available many plans would have been presented.

But few answers were given to the request for the names of possible donors. Few improvements or criticisms of the plan were suggested by foreign astronomers, in answer to the fifth question, a request for such suggestions. One or two advised that the committee should be international, but probably the general feeling was that, as it was hoped to collect the funds in the United States, it was only fair that they should be controlled by Americans. Among American astronomers, however, there were some objections for various reasons to the part it was proposed that Harvard should take in the plan.

Dr. Pickering begins the second pamphlet by stating that in order to attain as great an advance in astronomical research during the twentieth century as in the nineteenth, careful plans must be made for its endowment. The same skill in organization, combination of existing appliances and methodical study of detail, which in recent years has revolutionized many commercial industries, should produce as great an advance in the physical sciences. He considers seven methods by which astronomy can be aided. First, fellowships for astronomical students; second, astronomical expeditions; third, new observatories; fourth, publication of investigations and memoirs; fifth, aid to working astronomers; sixth, aid to existing observatories; and seventh, international co-operation.

While a large sum of money would be needed to carry out this plan in full it would seem that a moderate amount would permit a portion of it to be tested. Very different ends would be attained by the different methods. Thus, the first is educational and insures the efficiency of the astronomer of the future, the fifth aids the individual man of genius, while the sixth and especially the seventh undertake to solve the great problems now before us, and to advance the science to a new and higher plane. The seventh method stands on a wholly different basis from the others. Here the work must be done by experts, the greatest specialists in their departments. Many important investigations have been undertaken by international societies, and such work could be greatly increased if large sums of money were at their disposal for this purpose.

Dr. Pickering suggests the appointment of a local committee consisting of men interested in astronomy but not necessarily familiar with its technical details, with proper facilities for collecting the views of experts. The duties of this committee would be, first, absolute fairness. They should spend the income so as to secure the greatest scientific return, and should be wholly independent of all personal considerations and of all local conditions. Secondly, their work should be active, not passive; they should try to spend the income, not to preserve it.

The project of building a ship canal across Florida has again come to the fore, and there is a strong probability of its being carried out. A canal, known as the Florida Coastline Canal, is rapidly nearing completion, and now extends from St. Augustine on the north to Key West on the south, a complete inland way of over 380 miles.

MAMMOTH DREDGER USED FOR RECLAMATION WORK IN CALIFORNIA.

BY WILLIAM A. LAWSON.

What is said to be the largest dredger in the United States is now engaged in reclamation work along the Sacramento River, in California. It was recently constructed for that purpose, and far exceeds in size and capacity any other dredger built in that State, where for years past such machines have been used for levee building.

The hull of the dredger "Yolo" here illustrated is 53 feet wide by 115 feet in length, with a depth of 11 feet. The boom is 145 feet in length and its greatest diameter is two feet. The capacity of the bucket, level full, is 4½ cubic yards, but it has been known to lift as many as ten cubic yards at a time, in favorable soil. The weight of the empty bucket is 16,000 pounds.

The dredger is anchored or held in place while working by means of the four "spuds" shown in the picture, of which two are at the sides and two at the stern. They are round logs or timbers from 9 to 12 inches in diameter and 70 feet long.

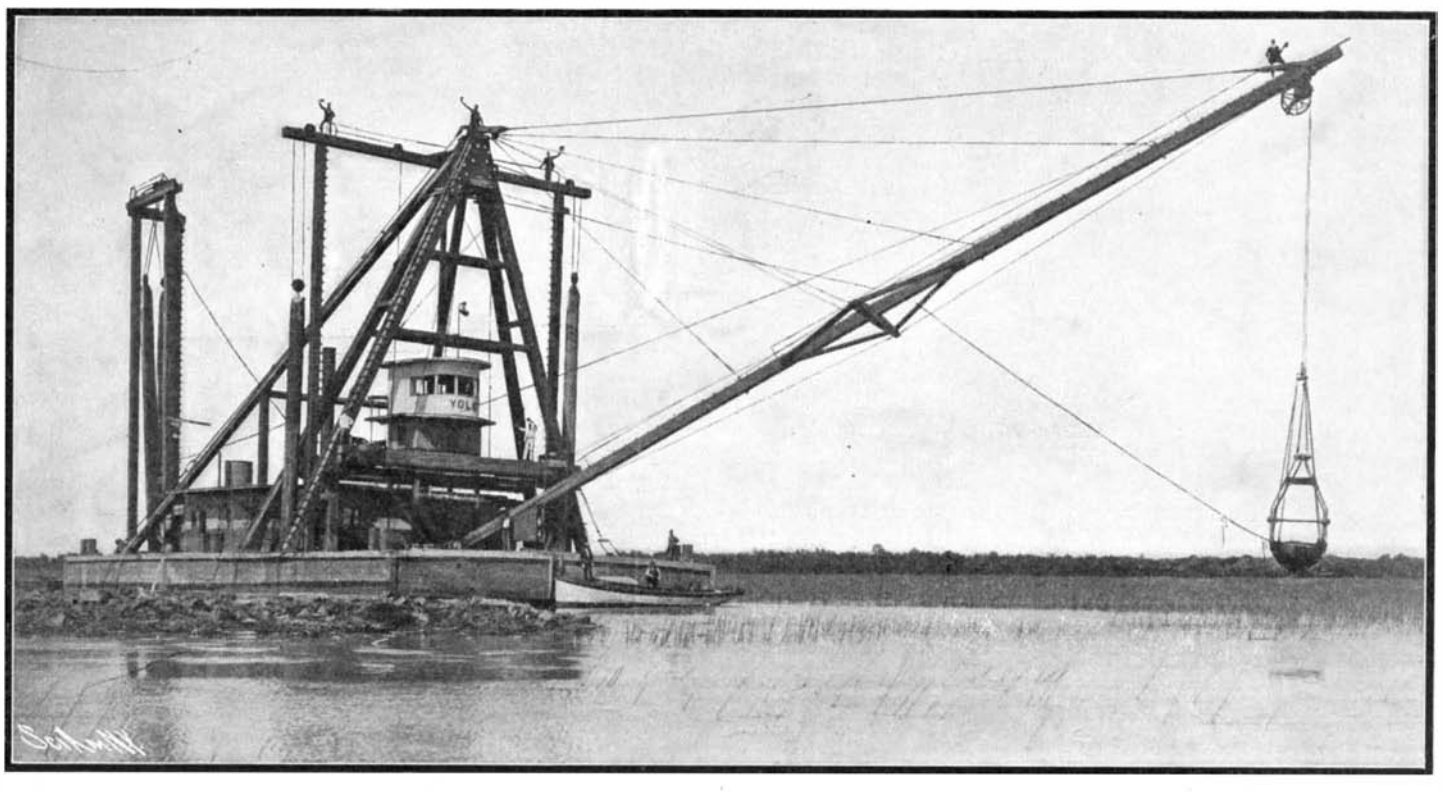
The fuel used is oil. The boiler is of the Scotch marine type, with a working pressure of 150 pounds to the square inch. The two main engines are of the tandem compound horizontal type, with high-pressure cylinders 14 inches in diameter and low-pressure cylinders 24 inches in diameter, and with a 20-inch stroke. There is an electrical plant for lighting purposes, the dredger being operated day and night, with two shifts of men each working twelve hours a day.

The bucket has a lift of 40 feet above the water level, and is swung into any desired position by means of the boom. The dredger can build a levee 18 feet high and 10 feet wide on top, with a slope of one in three, at the rate of half a mile a month.

Along the Sacramento and San Joaquin rivers and in the islands at their delta are about 750,000 acres of land naturally subject to overflow during seasons of high water. The rivers flow on ridges of their own creation, through the deposit of sediment on their banks in the course of ages. The bank lands, stretching back half a mile or more from the streams on either side, were not subject to inundation, but lying between them and the higher lands of the valleys are basins all of which were originally swamp or tule lands, but about 150,000 acres have been reclaimed by means of levees. These reclaimed lands are among the righest in the world, producing enormous crops of vegetables, alfalfa, fruit, grain, and seeds.

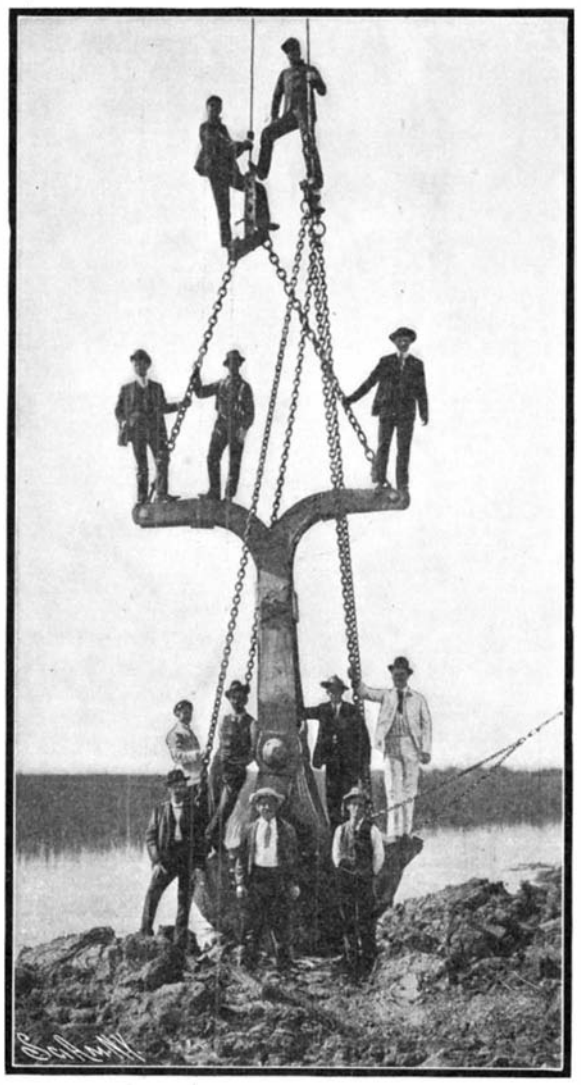
The cost of reclamation by means of levees and pumping plants, with canals and ditches, varies greatly according to conditions, and in some instances has been as high as $100 per acre. When reclaimed the land is worth from $100 to $300 per acre. The soil is a sandy or peaty loam, very rich in vegetable matter.

Reclamation has so far been confined to private districts, organized under a State law which allows the taxation of the lands of each district to defray the cost of levee building and other expenses. But at a late "river convention" in San Francisco it was decided that systematic reclamation should proceed under the direction and control of the State, and that three eminent engineers, non-residents of California, should be called in consultation with a State engineer and the Federal engineer in charge of the navigable streams in the State, for the purpose of forming a general plan of river improvement and reclamation. The object is to convert to fertility and productiveness more than 500,000 acres now almost useless. The cost is estimated at from $10,000,000 to $20,000,000, but it is expected that the lands reclaimed will be worth from $60,000,000 to $100,000,000.



THE GREAT DREDGER AT WORK.

The Muir Glacier of Alaska was formerly one of the points in greatest favor with the tourist, and for many years the boats loaded with excursionists were run directly up to the great ice mass. Such as were inclined to do so, were permitted to land and make photographs and other observations of the ice field. Occasionally enormous pieces of the ice would fall



THE BUCKET OF THE DREDGER.

from the front of the glacier, and with a mighty roar drop into the water. The mass would be lost to sight for a space of time which seemed to be several minutes, but eventually would come to the surface, roll over, and settle itself for its journey to the open water. Of more recent years, however, this great iceberg factory has been so active that it has been impossible for the boats to get within several miles of the glacier, and this feature of the trip had to be abandoned. In order to make some investigation of the matter, Mr. C. L. Andrews, of Skagway, a member of the National Geographic Society, made a trip of 150 miles in an open boat, and he announces that the glacier has lost its size and grandeur, and is receding at a very rapid rate. The face has moved back about three miles in four years, and in that time the glacier has lost about ten square miles of area. This rapid recession is said to have dated from the fall of 1899, when the vicinity was visited by an earthquake. Mr. Andrews is of the opinion that the end of the Muir as a tidewater glacier is near at hand.

Rubber Paving in London.

The following particulars regarding the rubber paving of the two roads under the hotel at Euston station may be of interest:

This paving was laid down in 1881 by Kirk & Randall, the contractors for the extension of the hotel. Its cost per square yard was as follows: Concrete foundation work, $5.60; rubber paving, supplied by Messrs. Macintosh & Co., $27.10; total approximate cost, $32.70.

When the rubber was laid down in 1881 it was 2 inches in thickness. In May, 1902, after twenty-one years' wear, the portion on the incoming road into the station was taken up and carefully examined, when it was found to have worn down to about five-eighths of an inch in the thinnest place, namely, at the incoming end, where horses first step on to it from the macadamized road. Other parts of the rubber were worn down to 1 inch and 1¼ inches, these places in each case being near the center of the roadway. Renewal was therefore considered necessary.

In recent years the price of India rubber has largely increased, and its quality varies. Tenders were invited in August, 1902, from four firms, and the prices received varied from £5 11s. 4d. ($27.09) to £17 10s. 3d. ($86.22) per square yard, Messrs. Macintosh & Co.'s price being £10 2s. 6d. ($49.26). The lowest price was accepted, namely, the tender from the India Rubber, Gutta-Percha and Telegraph Works Company, of £5 11s. 4d. ($27.09) per square yard. The material to be used is not, however, supposed to be pure India rubber, but appears suitable for the purpose, and is vulcanized. Rubber of a similar quality was laid in the year 1895 in Wellington Court 42, Albert Gate, Knightsbridge, London, and it was ascertained that "it had worn most excellently and given every satisfaction" at that place.

The total cost of the renewal in 1902 of the paving on the incoming road was £5 18s. 2d. ($28.75) per square yard, including laying, after credit had been given for the old rubber taken up. Since the paving was laid down in 1881 the average cost of general maintenance and examination has been slightly under 3¼d. (6½ cents) per square yard per annum.

At the recent addition to the Savoy Hotel, London, the courtyard was paved with rubber. The contractors, Messrs. James Stewart & Co., courteously supplied the following particulars concerning this pavement:

"The amount of rubber used in the Savoy courtyard is 2,195 feet, 2 inches thick, and the weight of the rubber is 15¼ pounds a square foot. It is laid on a concrete foundation, finished with cement floating to make it smooth.

"The cost of this material laid is 18s. 8d. ($4.54) per square foot, and it may be added that the cost for the same quality of material varies in direct proportion to the thickness.

"We have had no actual experience with this rubber paving for any length of time, but we investigated it pretty thoroughly at the time it was decided to lay it here, and found that the small piece at the entrance to the station at Euston was laid some twenty years ago. The traffic there has been very heavy.

"We think there is no doubt that the results of rubber paving will be entirely satisfactory, but the cost will undoubtedly make the adoption of it for general use prohibitive."

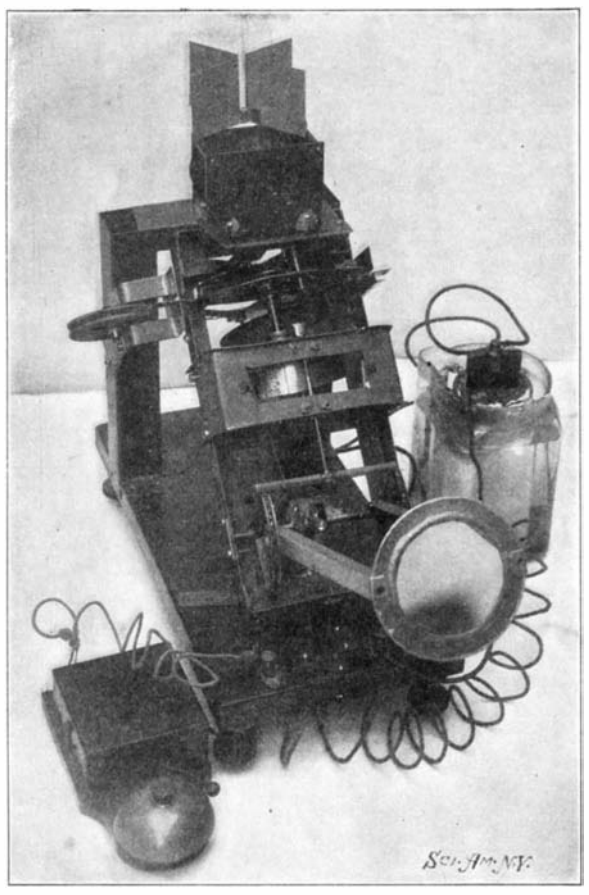
The court measures 75 feet by 50, and the cost of paving was £2,000 ($9,733).—H. Clay Evans, Consul-General.

In order to remove from lamp globes the unsightly grease spots frequently met with and to restore the handsome matt appearance of polished glass, pour two spoonfuls of a slightly heated solution of potash into the globe, moisten the whole surface with it and rub the stains with a fine linen rag; rinse the globe with clean water and carefully dry it off with a fine, soft cloth.—Neueste Erfindungen und Erfahrungen.

AN INSTRUMENT FOR INDICATING MEAN ASTRONOMICAL NOON.

BY EMILE GUARINI.

The time that separates two successive passages of the sun across the meridian is not always the same. Except for four days of the year there is always a



INSTRUMENT FOR INDICATING MEAN ASTRONOMICAL NOON.

difference between the time of an accurate clock (mean time) and the time indicated by a sun-dial (true time). This difference is called the time equation. On February 10, in France, the equation shows a retardation of 14.5 minutes, and on November 3 an advance of 16.5 minutes, a total difference, therefore, of 31 minutes. Since 1891, the time of Paris has been the legal time of France. It follows, therefore, that cities lying to the west or east of Paris would have to add to or subtract from the local time in order to legalize their timepieces. It is the purpose of the apparatus illustrated in the accompanying engraving to effect this correction in the equation of time automatically, and to indicate the exact moment when the sun reaches the meridian.

The apparatus consists of a substantial base plate upon which is carried a frame pivotally mounted on an axis parallel with that of the earth. At right angles to this frame a lens holder is carried, hinged at its lower end and provided with a lens, the focal point of which lies exactly on the line joining the pivots of the first mentioned frame. A clock train is disposed on the frame to the west of the meridian, in such a manner that its weight will always tend to bring the frame to this side. It will be observed from the illustration that the lens holder is operated from this clock train by chains, the movement being so timed that the lens keeps pace with the sun on its journey through the heavens. The lens has two movements, the one from east to west, the other from side to side around the pivots of the frame, both movements being automatically controlled from the clock train, and both being so timed that the rays of the sun are constantly received by the lens.

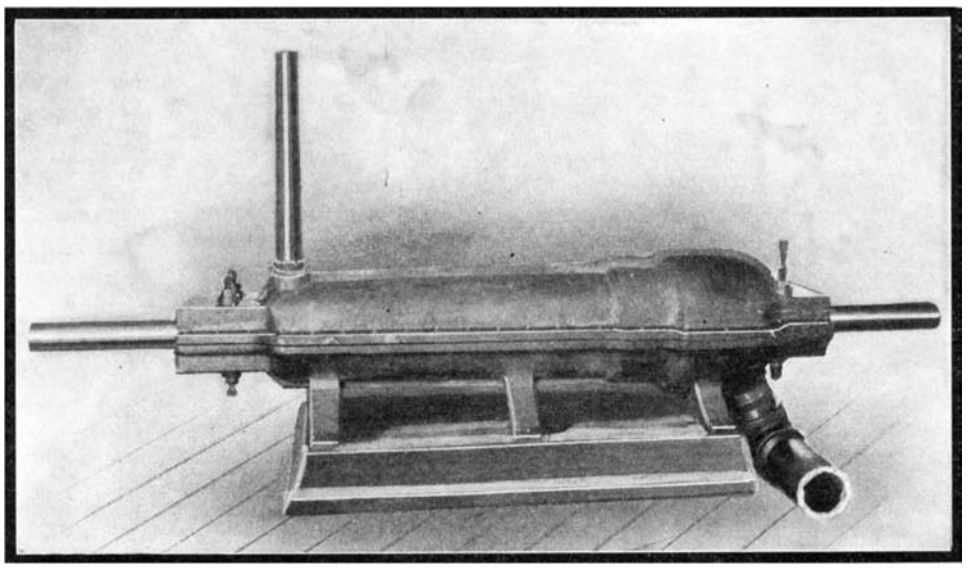
At Paris the true noon agrees with the mean noon on the 16th of April, the 15th of June, the 1st of September, and 25th of December. On these days the frame inclines neither to the right nor to the left, and the focal axis of the lens lies exactly in the plane of the meridian. When the sun crosses the meridian after mean noon, the lens, by inclining to the right, is alined with the sun before true (solar) noon; and when the sun crosses the meridian before mean noon, the lens inclines to the left and is not in line until after its passage of the meridian. The focal axis is thus displaced by a total angle of 7 deg. 42 min., corresponding to a difference of 31 minutes of time. In this double motion of right ascension and declination, the focus of the lens is always projected at the same point.

At the point where the rays are concentrated is placed a small barometric chamber of a U-shaped tube containing mercury and ether. Two insulated iron wires descend to the mercury and are connected with one or more electric bells placed at any suitable distance. When the focus falls upon the chamber the ether expands and acts upon the mercury, which, in contact with the naked extremities of the wires, completes the circuit, thus ringing a bell, and indicating mean noon.

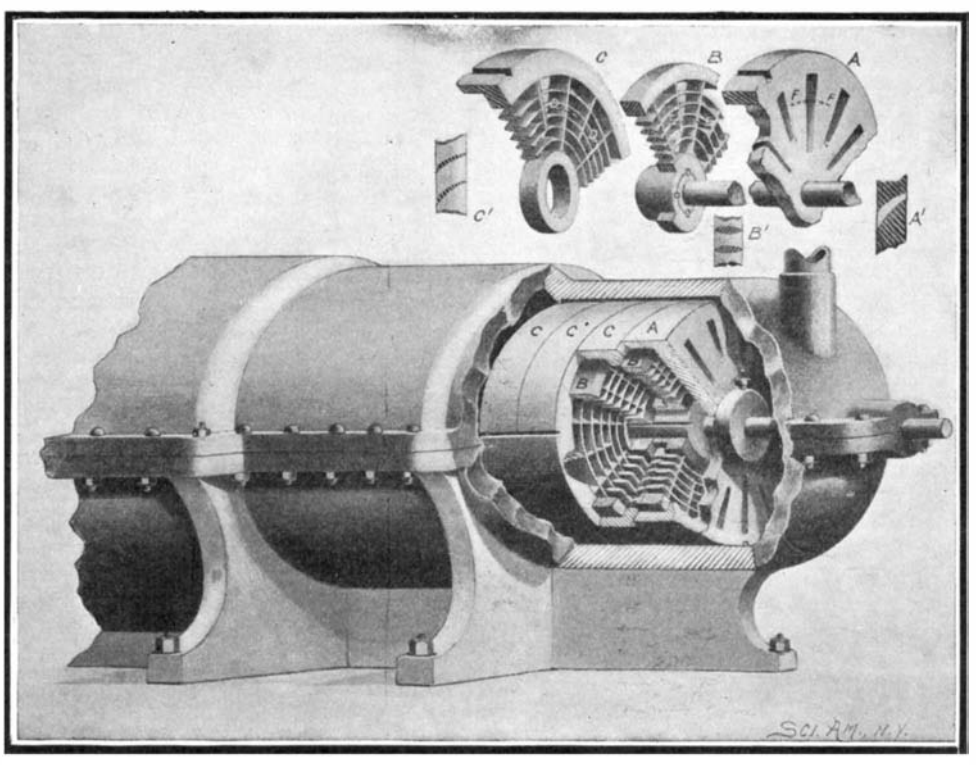
The apparatus may be installed at any point whatever of France after regulating it once for all by means of the leveling screws. A very ordinary clockwork movement is sufficient, since a variation of one hour a day could not possibly vitiate the result.

NEW STEAM TURBINE.

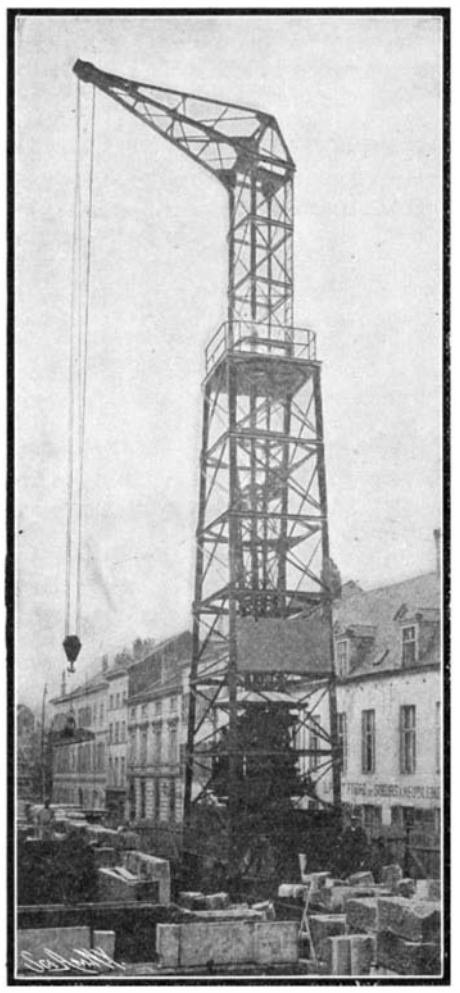
A patent has just been granted to Mr. Morgan D. Kalbach, of Lebanon, Pa. (Box 381), on a steam turbine of novel construction. The turbine is so designed as to secure the greatest expansion of steam and the utmost velocity possible in an apparatus of this class. One of our illustrations shows a portion of the turbine broken away to show detail. From this it will be observed that the turbine casing is made up of two sections bolted together and formed to provide a series of connecting cylinders of gradually-increasing diameter. Shoulders are formed at the end of each cylinder between which a series of partitions are held. At the inlet end of each cylinder a partition, *A*, is placed and the remainder of the space is taken up with a series of stationary disks or partitions, *C*. The partitions *A* and *C* are keyed to the casing so as to prevent them from turning. They are formed with annular flanges which overlie a series of rotating disks, *B*, interposed between them and keyed to the turbine shaft. The partition, *A*, is formed with a series of radial steam ports whose cross section is curved as shown at *A'*, which is a section on the line, *F F*, of Fig. A. These ports, it will be observed, gradually widen inwardly or toward the left, so that the velocity of the steam jet will be increased by reason of its expansion therein. The curved ports direct the jets at an angle against the blades of the disk, *B*, causing it to rotate. The shape of the disk *B* is indicated at Fig. B and section *B'*, which is taken on the line *E E*. The steam next encounters a partition, *C*, similar to disk *B*, but formed with curved radial vanes, at shown at *C'*, which is a section on line *D D*. These blades direct the steam at an angle against the blades of the next rotating disk, *B*. It will be observed that the segments inclosed by the radial vanes of the disks *B* and *C* are subdivided near the circumference by shorter radial arms. After traversing one cylinder, the steam passes to the next, which is shorter, but of larger diameter to allow for expansion, and so on until the discharge pipe is reached. By constructing each partition and each rotating disk in a single piece, the inventor is enabled to make the vanes very light, without reducing their strength, and much more so than in constructions where separate vanes are employed, and by subdividing the disks as the diameter increases, he is enabled to increase the surface area on which the steam can impinge.



GENERAL VIEW OF THE NEW TURBINE.



NEW TURBINE WITH CASING BROKEN AWAY TO SHOW DETAIL.



NEW GERMAN TOWER ELECTRIC CRANE.

A NEW GERMAN TOWER ELECTRIC CRANE.

BY FRANK C. PERKINS.

The accompanying illustrations show the details of construction, as well as a general view of a most interesting electrically operated tower crane constructed at Karlsruhe, by the Gesellschaft für Elektrische Industrie. The extreme height of the crane is 24.75 meters. The total height to which the hook may be raised is 23.5 meters, and the length of the arm or jib is 6 meters. This crane is designed to carry a load of 15,000 kilogrammes and the speed of lifting with a load

of 10 tons is 5 meters per minute, and with 3 tons 17.5 meters per minute. The crane is shown in operation in the city of Belgium, where a large armory is being constructed. The crane operates upon a track several hundred feet in length, the gage of the track being about 12 feet, or 3.25 meters. It is utilized for handling the large blocks of stone, carrying them from the cars on which they are transported to the building, and located where desired at the place of construction. The crane is operated by three electric motors, one of which is utilized for moving the tower crane on the rails, the second for turning the crane, and the third for raising or lowering the load. This type of tower crane is most economical in its operation, and entirely does away with the expensive scaffolding required in the construction of buildings within the capacity of the crane. It is stated that a new crane of this type is being built which will be about 120 feet in height, and will be of great service in the construction of high buildings. The crane of the tower type, it will be noted, not only takes the place of the scaffolding usually required, but also takes the place of the hoisting apparatus, doing its work vastly quicker and cheaper than it can possibly be done by old methods. It is of great importance in use on docks, and is designed to withstand great pressures and to resist the greatest wind velocities with ease. It may be operated on grades varying from 1 to 4 per cent, and is very stable in spite of the small gage of the track.

It is well known that the employment of electricity as a motive power has caused quite a revolution in the arrangement and working of cranes, hoists, and other apparatus used at various factories and works, as well as at docks and harbors. The application of electricity as a motive power has been of great advantage in connection with the operation of traveling cranes, as well as other forms of hoisting apparatus. The starting of cranes has been greatly facilitated by the use of electric current, and the relatively small weight and small space of the electric motors required for the different movements of the crane, has been of course of great advantage.

While it is true that hydraulic cranes are also driven from one central station, the power conductors consist of rigid inflexible piping, in many cases, which makes the crane almost, if not quite, stationary. The hydraulic crane has by no means the economical working of the electric crane, the consumption of water, and therefore of the power, being in proportion to the height to which the weight is raised, or to the length of way, and not in proportion to the work done. It will thus be seen that with the hydraulic crane, the expenditure of power remains at about the same high rate, whether heavy loads or light loads are handled. There is also the great danger with hydraulic cranes in case of very cold weather, where the pipes and other apparatus are exposed to hard frost. For traveling cranes, the hydraulic method is almost useless on account of the great difficulty met with in supplying the necessary power.

When steam cranes are employed, it is necessary to supply not only a steam engine and a boiler, but a fireman as well, and although long intervals may intervene between the operations of the crane, nevertheless its steam must be kept up all the time, thus wasting considerable fuel, and reducing the economy of operation. It is also necessary to employ the same steam engine for the several movements of the crane, as the use of three engines for the three principal movements of the crane would be excessively costly, to say nothing of the large amount of space which would be necessary. Even with a single engine, the amount of space required is excessive on account of the mass of complicated driving gear required in order to obtain the different movements. It is these reasons that render it more desirable under many conditions to operate cranes by electricity than by the compressed-air hydraulic, or steam methods.

PUMPING MACHINERY AT THE ST. LOUIS FAIR.

BY THE ST. LOUIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The wide variety and great total capacity of service rendered by the Worthington pumps at the St. Louis Exposition call for special mention. Three large rotary pumps, each designed for a capacity of 35,000 gallons per hour against a head of 159 feet serve to supply the Cascades in front of Festival Hall with water; each of these is driven by a 2,000-horse-power Westinghouse motor. In the boiler room there is installed a double row of fourteen 1,000-gallon Underwriter fire pumps which serve the mains for the entire fire protection of the Exposition grounds. Then follow the three 24-inch turbine pumps for circulating water in the power house. Here also are four boiler feed pumps, two of the vertical and two of the horizontal type, which serve the whole of the boiler installation in this building. There are also four 24-inch centrifugal pumps for handling the entire sewage of the Exposition grounds. Ranged along one side of the power house are the three centrifugal pumps with their engines direct-connected, which are shown in one of our front-page illustrations. Two of these pumps are constantly in service, with the third in reserve. One of the two in service delivers water to the cooling towers outside the building, and the other is the circulating pump for the surface condensers of the four large Westinghouse engines in the Machinery Building. Each of these three units consists of a Westinghouse high-speed compound engine, high-pressure cylinder 18 inches, low-pressure cylinder 30 inches in diameter, and a common stroke of 16 inches, steam pressure 150 pounds, and revolutions per minute 240, direct-connected to a centrifugal pump of 20,000 gallons capacity. The wheel of these pumps is 6 feet in diameter and both suction and delivery pipes are 2 feet in diameter. Another illustration shows two horizontal air pumps manufactured by the Laidlaw-Dunn-Gordon Company of Cincinnati. The larger pump shown to the left of the illustration has steam cylinders 13 inches and 24 inches diameter, air cylinders 22 inches and 14 inches diameter and a common stroke of 24 inches, both steam and air working compound. The capacity is 1,300 cubic feet of free air per minute against 100 pounds pressure. The smaller pump has steam cylinders 13 and 20 inches, and air cylinders 20 and 12 inches diameter and 12-inch stroke. Its capacity is 520 cubic feet of air per minute against 100 pounds pressure.

Correspondence.

The Catalpa Tree Again.

To the Editor of the SCIENTIFIC AMERICAN:

I have read a few articles in your paper in regard to the catalpa tree. While some, no doubt exaggerate its merits, I am disposed to believe that Mr. S. E. Worrell has as much underestimated it as others have overestimated it.

I have on my place a lot fenced with catalpa posts in the spring of 1886. In the spring of 1903 I rebuilt the fence, using the same posts but reversing the ends. Only about 10 per cent of these posts had rotted off. Catalpa contains an oil which prevents it from rotting internally. Above ground it wears away from the weather, and in the ground it takes a slow surface rot.

As to the growth: In the fence spoken of there was a small, round post from which a small bud put out at the ground and grew. This is a tree now, measuring fifty-four inches around or eighteen inches through, in eighteen years. This tree is on medium upland. It has a large top, but no larger than an oak or other trees under the same circumstances. Catalpa grows best on rich, moist bottom land. It should be planted about 10 x 10, or 400 to the acre, so that they will be slender. West Tennessee contains thousands of acres of bottom land which overflows so badly that it cannot be relied on for cultivation and can be bought cheap.

While speaking of timber and its lasting qualities, I wish to mention red mulberry and black locust. In the year 1867 my father planted a red mulberry gate post. In 1897 the post was taken up and moved and was rotted about one inch on the surface in the ground.

In the year 1877 three black locust trees were cut in my grandfather's yard. Twenty-seven years have passed and the stumps are so sound that one cannot shake them with a sledge hammer. Black locust is of slow growth but sprouts profusely and grows very thick and slender and roots deep in the clay.

In another article Mr. Dennis appears to be mystified as to the influence of power. In grinding corn it is generally admitted that the old-fashioned water mills make better meal than the modern steam mills. These water mills as a rule were of small power and used large rock (or burr) at a slow speed and ground from three to ten bushels per hour. The modern steam mill uses a small burr at a high speed—often a cast burr at almost the speed of a buzz-saw—and putting through it about twenty bushels per hour, the burr, meal and all around gets hot and the meal is ruined.

W. R. CRAWFORD.

McKenzie, Tenn.

Effect of the Sun Upon the Black Race.

To the Editor of the SCIENTIFIC AMERICAN:

It has always been a matter of much satisfaction to the scientist and the strongest corroboration of the truth of his conclusions, that his discoveries are immediately appropriated by co-workers in other fields and used in explanation of hypotheses or of demonstrated facts, independently discovered and frequently very remote in their general bearing. In this way, the chemist and the physicist have been the strongest supporters of the physiologist: the paleontologist and the biologist are mutually sustaining each other's theses; and the phychologist is both giving to, and accepting from, each of the other fields of organic science. All this is, of course, precisely what any believer in universal truths might expect and of itself is hardly worthy of comment. Yet such an expectation only serves to increase the rudeness of the shock which comes from what seems to be a direct contradiction between an existing fact in nature and a natural law so fully demonstrated as to be beyond question as regards its validity. This seeming contradiction expresses itself in the fact of the existence of the dark-skinned races in the tropics, and the physical law which asserts that black is a poor reflector, and consequently a good absorber of heat. Of both the fact and the law in its general bearing there is little need here of demonstration; for no black race is, I believe, indigenous to regions outside the tropics, and none of the whitest races to regions within them; on the other hand experiments with blackened thermometer bulbs and with different colored cloths upon the snow under the influence of direct sunlight as well as our experiences with black and with white clothing and shoes need only be alluded to in support of the law of absorption of heat. Why, then, is my query, are the black races placed in such relation to the sun's rays as to be most affected by them? And why did not nature compensate for the effects of color by placing them near the poles? It would, of course, be but begging the question to answer that the black races have in other ways been made more immune to the effects of heat by modifications in metabolic processes of life. It still remains to be shown why nature should have put herself to the trouble of accentuating an evil which must be corrected at some expense of energy. Seemingly the law of the survival of the fittest might have been just as potent in the racial elimination of pigment from the skin as in the elimination of any other unfortunate variation. Yet in accordance with what we know of the laws of the reflection of heat, the sensible effect of direct sunlight upon the negro should be more intense, by several degrees, than upon the white man. Why is it?

EDWIN GRANT DEXTER,
Professor University of Illinois.

Urbana, Ill., August 1.

The Current Supplement.

The current SUPPLEMENT, No. 1494, opens with a very full description of the Westinghouse exhibits at the St. Louis fair. Excellent pictures, especially taken for the SCIENTIFIC AMERICAN, accompany the text. Still other articles relating to the fair, which will doubtless be of interest, are those describing the State of Washington's building; the exhibit of war material, Mines and Metallurgy Building. All these articles are fully illustrated. W. N. Best, in an article entitled "The Science of Burning Liquid Fuel," gives much instructive information. "A Home-Made Water Motor of One-quarter Horse-Power" is the title of an illustrated article that will surely appeal to amateur mechanics. Walter W. Curtis outlines the history of timber treatment. An interesting paper on steel axles, read by J. L. Replogle before the Western Railway Club of Chicago, is abstracted. The English correspondent of the SCIENTIFIC AMERICAN describes a new process of manufacturing silicate-of-lime stone from sand. Lord Rayleigh recently delivered at the Royal Institution of Great Britain an admirable lecture on shadows. This lecture, revised by the author, is published in the SUPPLEMENT, together with all the illustrations of which Lord Rayleigh made use.

Dr. H. R. Mill, of London, in a paper read before the British Association, dealt with some difficulties experienced in the preparation of the rainfall charts for the United Kingdom which he exhibited. Many observers were wanted. The organization installed by the late Mr. Symons had splendidly developed, and they had now over four thousand, mostly voluntary, observers, of whom three hundred might change every year. The records extended over thirty and more years, but in some parts, especially in the north, they had very few gages. To arrive at average mean rainfalls over large areas, they had to allow for the different distribution of the stations, for the different lengths of the records, and the configuration of the country. It was very difficult to determine the average fall for any particular day; in that case the hours of readings and the methods of entering had to be considered, in addition to other points. When averages for the whole year were computed, some of those difficulties became less serious; but the unequal lengths of the periods of observation, and the absence of raingages in certain districts, made the results uncertain. There were such gaps in Wales, and, though he understood the prejudices against piling up data, we wanted more information. Collective continuity helped us over inaccuracies. Dr. Mill suggested several methods, including composite photography, for compiling his new maps, and it was the methods which he hoped to have discussed. The discussion by Messrs. W. Marriott, Assistant Secretary of the Royal Meteorological Society, W. G. Black, of Edinburgh, J. Hopkinson, of Watford, Prof. Turner and others, turned more upon details and the reliability of observers, however. In replying, Dr. Mill remarked that he wished that all the stations were as splendidly equipped as the Southport station.

THE 1905 ECLIPSE OF THE SUN.

BY MARY PROCTOR.

The last total eclipse of the sun observed was that of May 17, 1901, its path traversing the islands of Mauritius, Sumatra, Borneo, and New Guinea. The duration of totality in Sumatra amounted to six and a half minutes, the greatest observable eclipse of the last half century. Results of great value were obtained by Prof. Perrine, in charge of the William E. Crocker expedition from the Lick Observatory.

On September 20, 1903, a total eclipse of short duration occurred in the southern Indian Ocean. No effort was made to secure observations as the shadow did not pass over land, unless within the closed South Polar continent. Another eclipse will occur on September 9, 1904, which will go practically unobserved, since its path passes eastward over the central Pacific Ocean without touching any known islands, and terminates on the coast of northern Chile about six minutes before sunset. The Chilean astronomers are expecting to view the phenomenon, but further plans have not been made.

The next observable eclipse is that of August 30, 1905, and is looked forward to with unusual interest. The shadow path begins at sunrise south of Hudson's Bay, enters the Atlantic Ocean a short distance north of Newfoundland, crosses northeastern Spain, northeastern Algiers, and northern Tunis, passes centrally over Assouan on the Nile, and ends at sunset in southeastern Arabia. The duration of totality on the coast of Labrador, in Spain and at Assouan, are 2½, 3¾, and 2 3-5 minutes, respectively.

At Domino Harbor, Labrador, the eclipse begins (local mean time) August 30, 7h., 8m., 18s. A. M., the sun's altitude being 19 deg., and duration of totality 2m. 38.1s.

South of Luraca, Spain, the eclipse begins August 30 (local mean time), 11h., 14m., 39s. A. M., the sun's altitude being 55 deg. and the duration of totality 3m., 44.7s.

Southwest of Burgos, Spain:

Eclipse begins August 30, 11h., 31m., 05s. A. M.; totality begins August 30, 12h., 51m., 17s. P. M.; totality ends August 30, 12h., 55m., 02s. P. M.; eclipse ends August 30, 2h., 11m., 40s. P. M.; local mean time. Duration of totality, 3m., 45s.

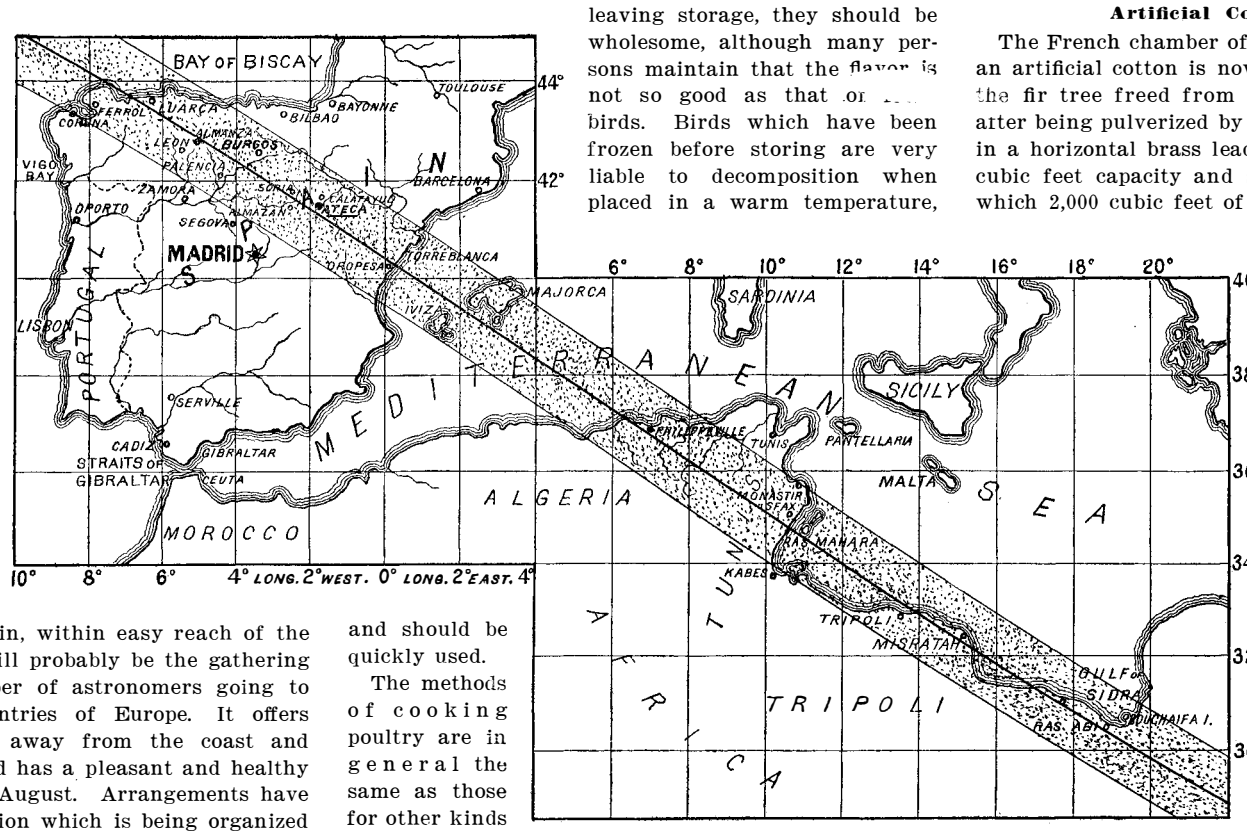
There is a tableland in the northern part of Spain, within easy reach of the town of Burgos, which will probably be the gathering ground of a great number of astronomers going to Spain from all the countries of Europe. It offers many advantages, being away from the coast and with less risk of fogs, and has a pleasant and healthy climate for a sojourn in August. Arrangements have been made for an expedition which is being organized by the writer of this article, to view the eclipse from the position southwest of Burgos, and the accompanying map shows the path of the 1905 eclipse. Members of the expedition will leave Boston or New York city July 1, 1905, allowing one week in Burgos for necessary preparations in viewing the eclipse.

Near Ateca, Spain, the eclipse begins August 30, 11h., 43m., 38s. A. M., the sun's altitude being 59 deg., and duration of totality 3m., 45s. Near Torreblanca, Spain, the eclipse begins August 30, 11h., 56m., 57s. A. M., the sun's altitude being 60 deg., and the duration of totality 3m., 44s.

Southwest of Philippeville, Algeria, the eclipse begins August 30, 39m., 34s. P. M., the sun's altitude being 62 deg., and duration of totality 3m., 35.7s. Near Ras Mahara, Tunis, the eclipse begins August 30, 1h., 5m., 7s. P. M., the sun's altitude being 61 deg., and the duration of totality 3m., 29.6s.

Southeast of Misrahtah, Tripoli, the eclipse begins August 30, 1h., 35m., 14s. P. M., the sun's altitude being 58 deg., and the duration of totality 3m., 19.7s. Northeast of Assouan, Egypt, the eclipse begins August 30, 3h., 26m., 28s. P. M., the sun's altitude being 39 deg., the duration of totality being 2m. 33s.

Expeditions from the astronomical observatories of the United States will probably make arrangements to view the eclipse from observing stations in Labrador. The Lick Observatory has issued a circular giving the times of duration of eclipse in Labrador, and emphasizing the necessity of having several good observing stations on this side of the Atlantic.



PATH OF THE SOLAR ECLIPSE, 1905.

Rails have been laid on the San Pedro, Los Angeles & Salt Lake main line from Calientes, Nev., southwest, 85 miles, and, unless unforeseen obstacles arise, the line will be in operation from Salt Lake City to San Pedro on the Pacific Coast early in 1905.

Poultry as Food.

Although not as many varieties of poultry are in common use in the United States as in Europe, and although eggs form perhaps the most important part of the total poultry industry with us, enough birds are raised and sold for their flesh to make poultry an important item in our list of foods. Chickens are, of course, far the most common of the kinds of poultry. Next come turkeys; then ducks and geese, followed by capons and squabs, the other varieties, such as guinea fowl, pheasants, and quail being least common of all.

In raising birds for the market special fattening has not heretofore been practised in this country with anything like the same frequency as in Europe; but American breeders are gradually coming to it more and more, especially on the large poultry farms which are springing up in many places. The extreme methods used so much in France are not, however, considered advantageous by most American breeders.

Live poultry is very commonly marketed, especially in the Southern States, where it is the custom to kill a short time before cooking, but, considering the country as a whole, it is doubtless true that the dressed birds are marketed more than the live, and the buyer must depend mainly on the appearance of the skin and flesh to tell him how fresh the bird is, and whether it has been properly dry-plucked or plunged into boiling water to make the plucking easier. In most cases, also, the age must be determined by the pliability of the breastbone or, in duck and goose, of the windpipe.

Cold-storage birds are frequently seen in the markets, especially in off seasons for fresh birds. If they have been properly stored and not kept too long after leaving storage, they should be wholesome, although many persons maintain that the flavor is not so good as that of [illegible] birds. Birds which have been frozen before storing are very liable to decomposition when placed in a warm temperature, and should be quickly used.

The methods of cooking poultry are in general the same as those for other kinds of meat. The tougher the bird the more cooking will be needed to make it tender and easily digested, and the larger it is the more heat will be required to cook it thoroughly. Canned and potted poultry are prepared in much the same way as freshly cooked dishes, and when properly put up do not differ essentially from similar fresh foods.

As regards composition, poultry does not differ as much as is commonly supposed from meat of other domestic animals used for food. Individual kinds and specimens, of course, vary in the relative amounts of protein and fat contained, and there are certain flavors present in poultry which differ from those in other meats. But these differences are so small that they are practically negligible in ordinary diet. Nor is there as much difference in digestibility as is often stated. On the average, poultry is somewhat more easily digested than beef and mutton, but only very slightly. The difference in digestibility between the various kinds of poultry probably depends on the amount of fat contained, the fatter sorts being least easily digested. Tenderness of fiber may have something to do with both ease and thoroughness of digestion, and, if so, young birds are more easily digested than old, and the less-used muscles of the chicken, such as the breast, more so than the much-used muscular tissues of the legs. Similarly, white-fleshed birds may be more easily digested than dark-fleshed, because the fibers of their flesh are less closely set; but this is not fully proved. Indeed, very little is positively known on this subject, and that little seems to indicate that the differences in thoroughness of digestion are very slight, and that cooking has much more to do with the digestibility of the birds than these slight differences in composition and texture. The price of poultry varies largely with the region and the season, and, as regards retail price, with the particular market. Although the proportion of refuse, water, and indigestible nutrients which each particular sort contains makes some difference in its real economy as a source of nourishment, the price is, after all, the most important consideration. Reckoning the cost of the actual nutrients, we find that chicken is, on the whole, the cheapest kind, and compares favorably in economy with cheap cuts of beef and pork. Chicken, at low or average prices, then turkey and goose, follow in order of real economy, and furnish about as much protein and energy for a given amount of money as sirloin of beef or leg of mutton. Out-of-season chicken and turkey, capon, duck, and green goose are slightly more expensive, while squab, pheasant, and quail are so dear as to be luxuries. Save chickens, then, poultry can hardly be used economically by the very poor, but the cheaper kinds may be economically used by the moderately well-to-do, while all kinds except the very costly might well be more frequently used by those who can afford to pay for a pleasant variety in their diet. In sickness delicate poultry is often valuable far beyond its cost, because it is so appetizing and is at the same time fairly easily digested. The rapid increase in the amount of poultry raised for the table in this country is strong proof that it is becoming more and more popular, and although it may not deserve its popularity on the grounds of strict economy, it certainly does earn it by its attractive flavor, easy digestibility, and the pleasant variety it gives to our meat list.—Helen W. Atwater, in Farmers' Bulletin No. 182.

Artificial Cotton in France.

The French chamber of commerce of Milan says that an artificial cotton is now made from the cellulose of the fir tree freed from bark and knots. The fibers, after being pulverized by a special machine, are placed in a horizontal brass lead-lined cylinder of some 3,500 cubic feet capacity and steamed for ten hours, after which 2,000 cubic feet of a bisulphate of soda wash is added and the whole is heated for thirty-six hours under a pressure of three atmospheres. Then the wood, or fiber, which has become very white, is washed and ground by a series of strong metallic meshes, after which it is again washed and given an electro-chemical bleaching by means of chloride of lime. Passage between two powerful rollers then dries the matter, producing a pure cellulose, which when reheated in a tight metal boiler containing a mixture of chloride of zinc and hydrochloric and nitric acids, to which is added a little castor oil, casein, and gelatin to give resistance to the fiber, gives a very consistent paste. Threads are then produced by passing this paste through a kind of drawplate. These threads, after being passed over a gummed cloth, are immersed in a weak solution of carbonate of soda and passed between two slowly-turning drying cylinders. Finally, to give the necessary solidity, the thread is treated to an ammoniacal bath and rinsed in cold water, after which the product is pliable and works well.

In Bavaria experiments have recently been made to produce cotton from pine wood, and it is claimed that the trials have been very successful.

An important alteration will be made shortly in the construction of the large battleships in the German navy, says the Berlin correspondent of the London Standard. The improvements in the manufacture of armor plates, together with other reasons, have necessitated the strengthening of the central battery. It is intended to substitute for the 17-centimeter quick-firing guns, which now form the armament of the central battery, 21-centimeter quick-firing guns. It is pointed out that if a ship of the "King Edward VII." class were opposed by a ship of similar size and defensive power, but possessing 21-centimeter guns in the central armament instead of the present 17-centimeter guns, the latter would have a considerable superiority in an artillery duel beyond torpedo range.

Portland cement work should be allowed a year to harden and dry before applying oil paints. A solution of common water-glass in three or four parts of water should be applied first. Two coats of this, followed by washing with water, and then applying another coat of water-glass, have been found effective.

ADMIRAL TOGO'S FLAGSHIP "MIKASA."

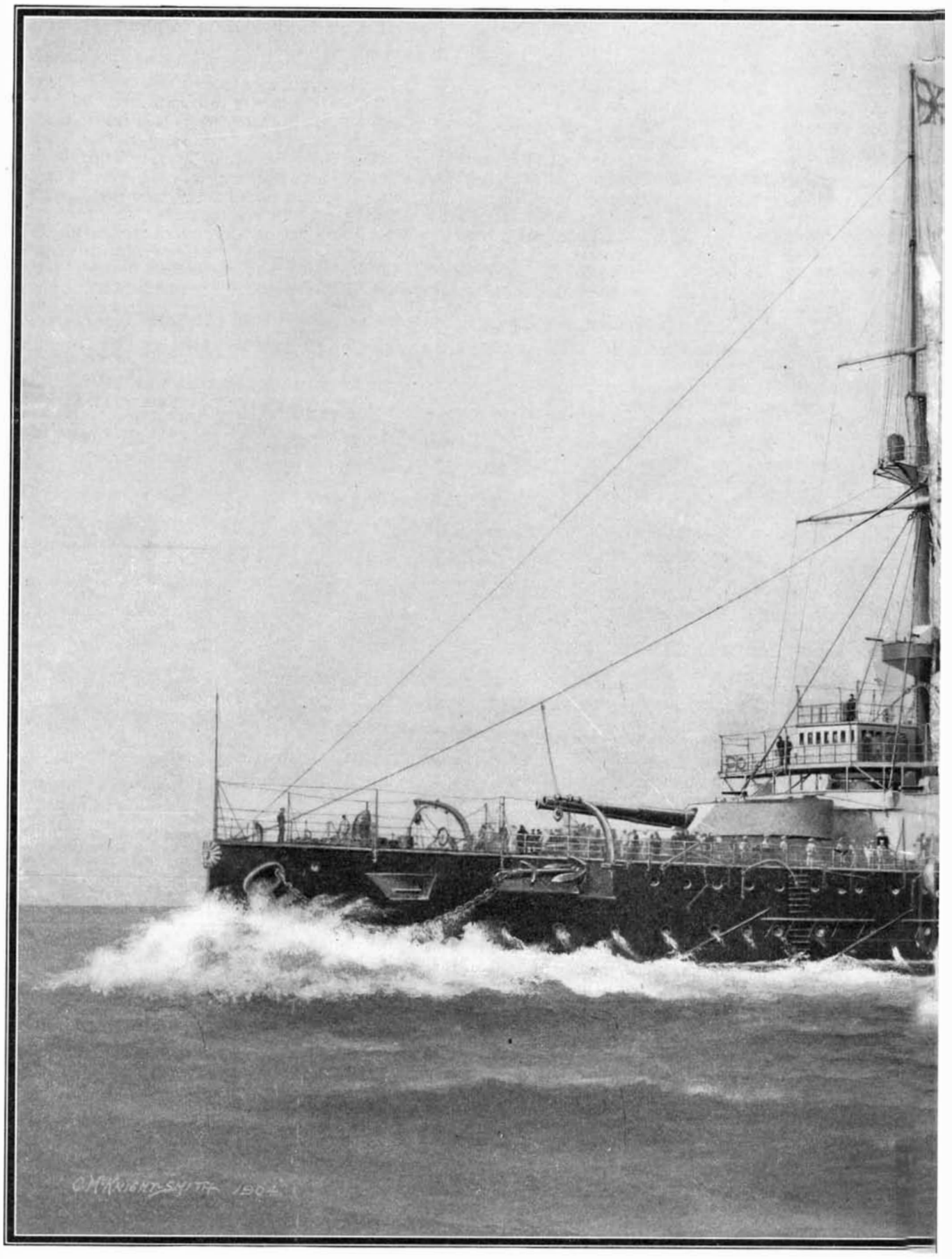
Among the personnel and the war material of the Japanese naval forces that have been thus far engaged in the Russo-Japanese war, the most conspicuous units have been Admiral Togo and his great flagship the "Mikasa." Just as Port Arthur is the center and most important objective of the naval war, so the "Mikasa" is the central point around which revolve the various elements, battleships, cruisers, scouts, gunboats, and torpedo boats, in fulfilling their various duties in the campaign. What the tent of the ranking officer and the headquarters staff is to an army in the field, the admiral's cabin of the "Mikasa" is to the fleet of ships whose operations extend from Vladivostock to Port Arthur and from Newchwang to Nagasaki. It must not be supposed that an admiral of a fleet always selects the largest or most formidable fighting vessels for his flagship. Sometimes, as in the case of Admiral Sampson at Santiago, the choice is made of an armored cruiser, the "New York" having been in that case selected as the flagship, although there were five battleships, among which was the "Iowa," included in the blockading fleet. Usually it is the question of accommodations and of the speed and handiness of the vessel that determines the choice. In the present case, however, Admiral Togo's flagship is the latest and most powerful battleship in the Japanese navy, and she was probably fitted for use as a flagship at the time that she was built at the yards of Vickers, Sons & Maxim in Great Britain. The admiral's quarters are situated at the extreme after part of the vessel, on the main deck, below the quarter deck.

The SCIENTIFIC AMERICAN has made its readers familiar with the leading characteristics of the "Mikasa," and reference is made to the previous illustration of this vessel, showing her, bows on, at the moment when she is supposed to be leading the fleet into action. In that view she was shown with everything stripped. The accompanying illustration shows a quartering view from off the port bow. It represents the "Mikasa" when steaming at a speed of 18 knots, or over 20 miles an hour. The vessel has the following leading dimensions: Length over all, 400 feet; breadth, 76 feet; draft, 27¼ feet, and displacement, 15,200 tons. The length of the ship between perpendiculars is 400 feet. The "Mikasa" is modeled on the lines of the British 15,000-ton battleships of the "London" type, the chief difference being that she has 1 foot more beam and 1¾ feet less draft. She is a better protected ship than the "London," however, for the reason that those 6-inch guns of her intermediate battery, which are mounted on the main deck, are protected by a continuous wall of 6-inch armor instead of each gun being mounted, as in the case of the "London," in a separate casemate, with the stretch of the ship's side between the casemates entirely unprotected. This unprotected portion of the ship would allow the shells, which would be stopped by the continuous wall of armor of the "Mikasa," to pass through and burst in the interior of the ship between decks, at the risk of killing or maiming the crew and disabling the 6-inch guns on the opposite side of the ship. The "Mikasa" is protected at the water line by a continuous belt of Krupp armor, 9 inches amidships and tapering to 4 inches at the ends. With the side armor is associated a steel deck, which is 4 inches thick on the side slopes. Moreover, in the wake of the main turrets of the 12-inch guns, bulkheads of 14-inch Krupp armor extend athwartship to a junction with the barbette armor, so that projectiles which might enter through the unarmored ship's plating forward and aft would be stopped by the bulkheads and prevented from making a clean sweep through the ship. Extending from the top of the main water-line belt to the upper deck, and covering the whole space of the ship between the main barbettes, there is a continuous wall of 6-inch Krupp armor, which is pierced by gun ports on each side for the ten 6-inch guns, which are mounted on the main deck. Above this armor belt on the upper deck at the four quarters of the ship are four 6-inch guns mounted within casemates of 6-inch armor. The four 12-inch guns are carried in two barbettes of 14-inch armor, protected by hoods or light turrets, with sloping armor 10 inches in thickness in front and with vertical armor 8 inches in thickness at the sides and in the rear. The twenty 3-inch rapid-fire guns are mounted as follows: Two forward and two aft on the main deck: four on each broadside on the upper deck between each pair of 6-inch gun casemates; four on the roof of these casemates, and two on the forward bridge, and two on the after bridge. There are also a dozen 3-pounders and 2½-pounders carried on the superstructure bridges and fighting tops. Four 8-inch submerged torpedo tubes are provided, one on either beam in the wake of the forward barbette and one on either beam in the wake of the after turret. The ship is driven by engines of 16,400 horse-power at a speed of 18.6 knots an hour. She carries normally 700 tons of coal, but is able to stow 1,500 tons. An interesting feature is that no less than 4,600 tons of armor are worked into this ship.

The long-looked-for time has evidently been reached, when the siege guns of the investing Japanese armies could render the anchorages of the Russian fleet within the harbor of Port Arthur unsafe. It is probable that the high-angle fire from these guns was finding its way through the protective decks and threatening engine rooms and magazines. Hence the sudden sortie of the whole fleet in an attempt to reach Vladivostock or effect a junction with the armored cruisers from that harbor.

The fleeing ships were intercepted by the Japanese, and the results of the battle were fearfully disastrous to Russia. Not only was the attempt to effect a junction with the Vladivostock squadron frustrated, but the Port Arthur fleet was scattered and many of its ships so badly crippled that they must be stricken off the list of effectives. The "Czarevitch" has fled to the neutral port of Tsing-Tau, where she must be dismantled; the five other battleships are reported by Admiral Togo to have returned, badly damaged, to Port Arthur, where they will be again under the fire of the Japanese siege guns. Of the cruisers, the "Askold" is in the neutral port of Shanghai, badly crippled, and the other cruisers are not yet accounted for. The rout of the Port Arthur fleet is complete.

As we go to press, news comes of the defeat of the Vladivostock squadron by the ships under Admiral Kamimura. The "Rurik," of 10,940 tons, was sunk; the "Rossia" and "Gromoboi" fled to Vladivostock.



Displacement, 15,200 tons; Speed, 18.6 knots; Coal Supply, 1,500 tons; Armor, belt 9 in., deck 4 in., barbettes 14 in., casemat

ADMIRAL TOGO'S FLAGSHIP, THE FIRST-CLASS BATTLESHIP "MIKA

Atoms.

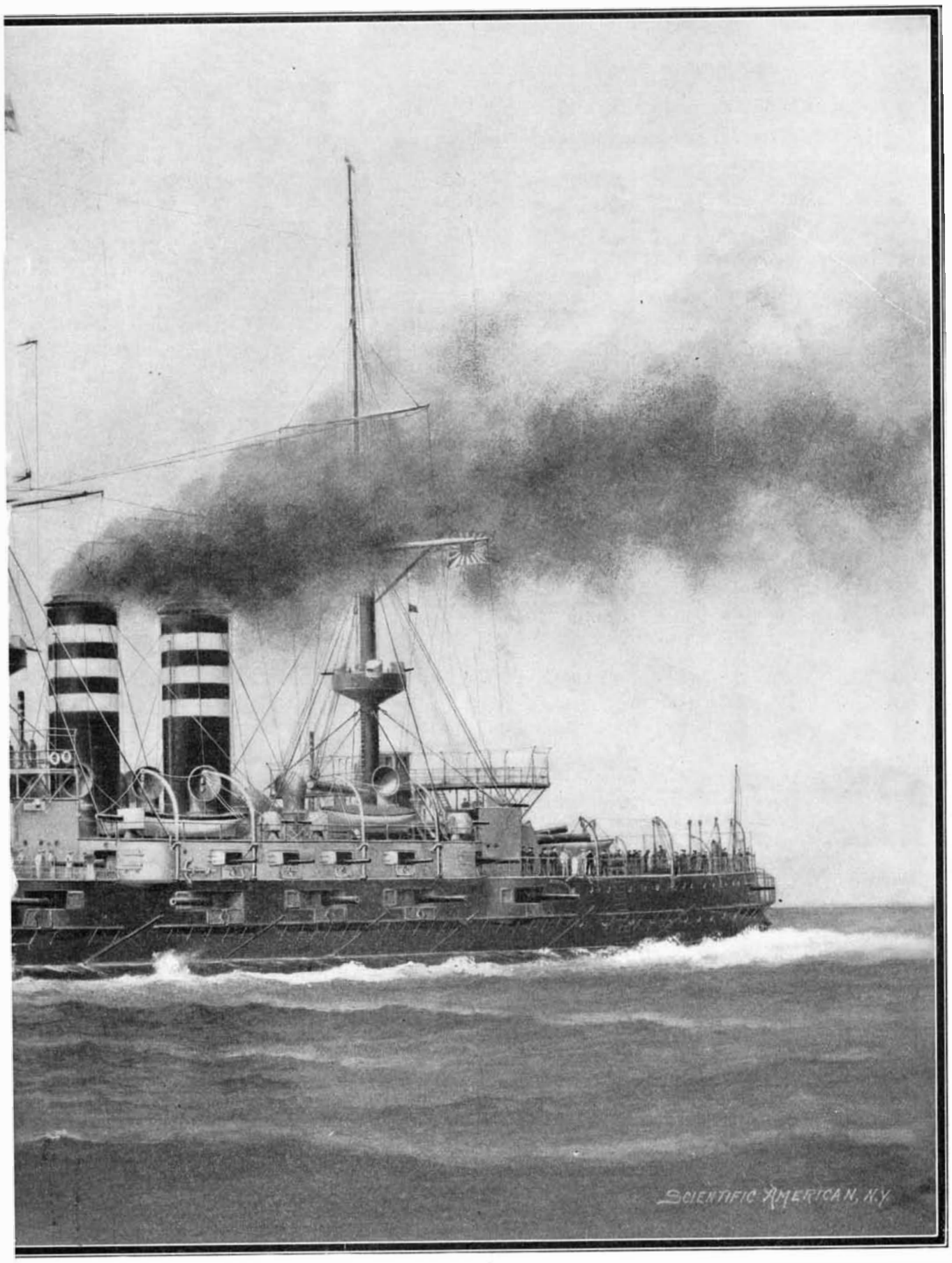
Sir Oliver Lodge, F.R.S., in view of the interest that is being manifested at the present moment concerning atoms, has contributed to the English press the following interesting popular description of the atom and how it is measured.

The idea of the atom is as old as Democritus and Lucretius, and it was revised and made relatively quantitatively definite by Dalton a century ago. An atom meant the ultimate indivisible unit or particle of matter indivisible either in the sense that no one knew how to split it up, or in the sense that if by any means hereafter it was ever subdivided, its parts would no longer correspond to what had been known as matter, but would be something new and unknown. A third sense might no doubt be foisted on the word, viz., that by no conceivable possibility could such a unit be ever subdivided; but that is an indefensible use of the word.

Take a diamond and crush it, pick out the smallest fragment and crush that, then with a microscope pick out the smallest particle, and, if you can, crush that further, and so on in imagination several times. You at length arrive, let us say, at a particle which is still a true diamond, but which, if you were able to take anything away from it, or to cut it further, would no longer be a diamond. That ultimate particle could be properly spoken of as a diamond atom. It need not be an atom of carbon—though a diamond is a crystalline form of carbon—because to form a crystal prob-

ably many carbon atoms are necessary. If the particle can be dealt with further, the next step would be to decrystallize it and reduce it to carbon, the smallest imaginable portion of which would be rightly called a carbon atom, provided the condition were fulfilled that if cut up any further it would cease to be carbon. The assertion that carbon is an element or elementary substance applies the idea that it is not possible by any known means to subdivide it. At the same time it would be legitimate to speak of carbon as an elementary substance, in the sense it was not composed of any known elements, and that it possessed a set of properties distinguishing it from other bodies called compound, without intending to signify that even though it had connoted indivisibility. Nor would it be convenient to style the particles of dust bricks.

Now about the absolutely quantitative aspect, or determination of the size of the atom, or enumeration of the atoms in the given weight of material. The real meaning of the phrase is a determination of the coarse-grainedness of matter. If matter were homogeneous and infinitely uniform throughout down to its minutest parts, there would be no meaning in the inquiry, and no meaning in the idea of atoms. Water, to the eye of sense, may seem to be in this predicament, but the atomic theory definitely asserts, and truly asserts, that that appearance is deceptive, and that it is ulti-



6 in.; Armament, four 12-in., fourteen 6-in., twenty 3-in., twelve small guns; Torpedo Tubes, four submerged; Complement, 730.

," FROM WHICH HE DIRECTED THE RECENT GREAT NAVAL FIGHT.

never could it be resolved into an aggregate of some unknown and purely hypothetical entity constituting a material substratum, or still more fundamental unit, of which other elements, too, could be composed.

In a very real and definite sense all matter is truly composed of atoms, just as a plant is composed of cells, and as a house is built of bricks. The bricks may, we know, be crushed to powder, but then they are no longer bricks. A brick—or at any rate half a brick—is in a sense the indivisible or ultimate unit of a house. A brick may be considered the molecule of which half a brick is the atom. One can imagine adamantine bricks which have been thought uncrushable, then the reduction to powder would be a discovery; but the name "brick" need not be altered, mately granular, or composed of atoms, like a pile of cannon shot or of a granary of wheat.

Any laboratory process which gives a measure of coarse-grainedness will give an estimate of the size of atoms. There are a multitude of ways of estimating coarse-grainedness, and they all lead to the same result, that is, to a result of the same order of magnitude, not identically to the same precise figure, but to figures to which all are approximately equal within small discrepancies.

One method is by measuring the action of a block of transparent matter upon the waves of light. It does not transmit them all at the same rate; it transmits the big waves quickest and the small ones less quickly. We know this because if set obliquely it bends them differently, and so sorts them out according to size, giving what we call a spectrum, for the different-sized waves produce in our mind, through our eyes, the sensation of different colors.

The size of each wave of light is accurately known, and the different retardations which they undergo depends on the fact that the structure of matter is not infinitely finer-grained than the light waves themselves. Grainedness of structure is, in fact, the reason of the colors shown by mother-of-pearl, by finely-ruled buttons, by mist on a window pane, and also, though less obviously, by a prism.

But perhaps the simplest though not the most exact way of arriving at a rough estimate of the size of atoms is by measuring the thickness of a soap-bubble film, where it is as thin as possible just before it bursts. Such a film, if composed of atoms, must be something like a pebble wall. Now a pebble wall would not stand if it were not several pebbles thick, and if we had reason to suppose that it was about a dozen pebbles thick we could easily make an estimate of the size of a pebble by measuring the thickness of the wall. That is the case with the thinnest region of a soap film. It is found to have a very definite and uniform thickness. It is the thinnest thing known, and, by refined optical means its thickness can be accurately measured, in the same sort of a way as a flake of feathery glass can be measured; but, although so thin, it is as strong for a time as the rest of the bubble, for it stands the pull of the rest. It must contain not less than something like a dozen atoms in its thickness for this to be possible, and yet it is only about the twenty-millionth of an inch in thickness by direct measurement. So that the diameter of an atom comes out between one two-hundred-millionth and one three-hundred-millionth of an inch, or, in other words, from about 200 to 300 millions of atoms can lie edge to edge in a linear inch. This is equivalent to the statement that an apothecary's grain of ordinary solid or liquid contains a number of atoms comparable to nearly a million million million million—i. e., that the number is something less than a quadrillion per grain.

Any one line of argument or method of estimation may seem weak, but a number of separate and quite different methods, all leading to the same results, are like the strands of a rope, not like the links of a chain; and the approximate size of atoms has been known any time this last thirty years, chiefly by the arguments of Loschmidt, Dr. Johnstone Stoney, and Lord Kelvin.

As to the recently-discovered electrons, they are excessively smaller, but it is a great mistake to assert that thousands of millions of millions of them are to be found in each atom. If so, they would be packed closely together; and they are never so packed. A statement that an atom is big enough to hold this number if they were jammed into it truly represents their size, but not their actual distribution; in practice there are always spaces between them, great in proportion to their size. Though hydrogen is the lightest atom, and though the heaviest kind of atom contains 250 times as many, yet that number is not able to occupy more than a barely appreciable proportion of the whole available space inside the individualized region which we style an atom of matter.

In a note recently read before the German Physical Society, A. Gehrcke describes some experiments of some interest in connection with an observation made by Prof. E. Warburg, viz., that sulphuric acid, being normally decomposed by the electric current into oxygen and hydrogen, disengages at higher temperatures sulphur and sulphureted hydrogen at the cathode. In the course of an investigation into the spectrum of hydrogen, the author happened to observe that even at ordinary temperatures, besides the normal products, sulphureted hydrogen, sulphur, and sulphurous acid are obtained. This interesting phenomenon is best observed by means of a special apparatus allowing of any desired current density being produced on a pointed electrode. These phenomena are by no means connected with a given concentration of the sulphuric acid. For concentrations above or below those mostly used by the author (1:4 to 1:6), the same phenomena will take place, though requiring more time in order to be observed. As regards a possible explanation of these experiments, the author is not able to ascertain whether the latter are exclusively due to the rise in temperature occurring at the point of maximum current density. The high fall of potential which takes place at the same point could in fact equally play a part in these phenomena; and the latter would in this case exhibit a possible analogy with those observed in connection with discharges in gases.

The new main shaft of the Waihi gold mine in New Zealand was sunk 83 feet in eighteen days. The shaft is 32 feet long by 8 feet wide, and is timbered with 9 inches square sets, with lagging. The depth referred to was from 20 feet to 103 feet from surface, the shallowness being necessarily favorable to speed of sinking.

Mail Automobiles in Denmark.

The automobile commission recently sent abroad by the Danish government on a tour of inspection with a view to reporting as to the adaptability of the automobile for short-route mail service has just returned to Copenhagen. The commission is composed of officials from the post-office and other governmental departments and engineers appointed by the government. The following comments upon their work, which appeared in a recent issue of the Dannebrog, a leading Copenhagen daily, may be of interest to automobile manufacturers:

"The members of the commission visited a large number of places in north and central Germany, France, and England. The object of the commission was to investigate to what degree the automobile might be made a substitute for secondary railways.

"From what we have learned it was evident to the commission that the automobile offers the best of service in places where the modern machine has been employed in the public service. The automobile reaches its destination on time, and has advantages over the railway train, which often in foreign countries, especially in England, fails to arrive on schedule time. It is, however, only on the shorter routes that the automobile has as yet been introduced into the postal service.

"The greater number of foreign automobile manufacturers have hitherto paid little attention to the construction of automobiles for practical purposes. The few manufacturers who have, however, given special attention to this subject have been successful, as is evidenced by the cordial reception which the public has given the automobile omnibus, for instance.

"If speed were not a consideration, it was evident to the commission that it would not be advisable to replace the present stage service with automobiles. On the other hand, if quicker delivery is the main object, the automobile will best meet the requirements.

"It is the intention here in Denmark, possibly, to replace the day coaches (stage service) by automobiles. It will be required that the automobiles have a speed of about 12 miles an hour on the average, which is about the speed maintained in the public mail service in foreign countries."

The Danish government has recently entered into a ten-year contract with a local company for the delivery of mails over the stage routes in Denmark proper. This company proposes, with the consent of the post-office department and under its supervision, to install automobile coaches in place of horse-drawn vehicles. This is an important branch of the postal service, since there are so many small islands without railways. The passenger and freight traffic makes many of the routes quite profitable.

Four automobile omnibuses of French and, probably, German and Scotch manufacture will be given a three months' trial, beginning with September of this year. It is confidently expected that the experiment will be successful, and if so, that there will be a large demand during the next two or three years for automobiles of the omnibus type.

The following are the rather severe conditions to be met before any particular make of automobile will be purchased:

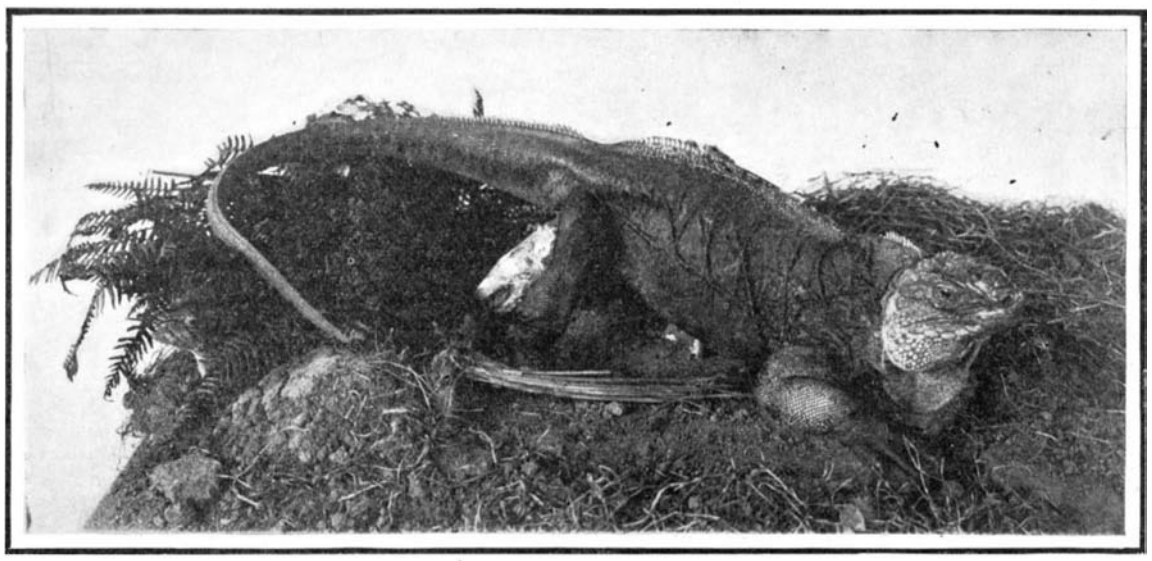
The body of the car (exclusive of machinery) must be approved by the commission. The machine must be run 2,000 kilometers (1,243 miles), after coming from the factory, at the maker's expense, an inspector appointed by the commission being on board all the distance. The car is then to be taken apart and each part carefully inspected, cleaned, and readjusted, and the car is to be run for three days at expense of maker. The car will then be forwarded to Copenhagen and run for three months by a driver furnished by the maker, who shall be accompanied by an agent of the commission. The commission will pay the salary of the driver, will furnish gasoline and oil, and provide housing for the car. The commission will pay one-third the price of the car on ordering it, one-third on its delivery in Copenhagen, and one-third at the end of the three months' trial, if it is found satisfactory. The trials are to be conducted under the supervision of the post-office department, and from their decision there is no appeal.

The car must accommodate sixteen persons, including the driver, and be capable of carrying 1 ton of freight besides, at an average speed of 12 miles an hour on a 2 per cent grade. The commission has practically determined to try the "Schneider-Creuzot" French omnibus, a car with a quadruple gasoline cylinder of 24 horse-power, costing $3,600, and accommodating twelve passengers inside and three on the platform. This car is at present most in favor with the commission.

THE IGUANA.

Among the interesting specimens brought back from the Bahamas by the expedition sent out by the Museum of Natural History of New York was a live iguana about three and a half feet long. This example of the *Pachyglossæ* was found on the Island of Andros where, as in the other islands of the group, the natives regard the animals as delicacies, hunting them by smoking them out of their burrows in the pine thickets.

The iguanas, a family of lizards, belonging to the sub-order mentioned above, comprise fifty-six genera and 236 species. With a single exception, all the genera of this extensive family belong to the New World, being especially characteristic of the Neotropical region, where they occur as far south as Patagonia, while extending northward into the warmer parts of the Nearctic region as far as California and British Columbia. The iguanas are characterized by the peculiar form of their teeth, these being round at the root and blade-like, with serrated edges toward the tip, resembling in this respect the gigantic extinct reptile the iguanodon. The typical forms belonging to this family are distinguished by the large dewlap or pouch situated beneath the head and neck, and by the crest, composed of slender, elongated scales, which extends in gradually diminishing height from the nape of the neck to the extremity of the tail. The prevailing color is green; and, as the majority of them are arboreal in their habits, such coloring may be generally regarded as protective. Those, however, which reside on the ground have much duller, though as a rule equally protective, lines. Iguanas possess to an extent exceeded only by the chameleon the power of changing their colors. Though the natives of the Bahamas claim that these lizards live on fruits and the tender shoots of plants, many scientists assert that they are insectivorous.



AN IGUANA BROUGHT FROM THE BAHAMAS.

Col. Renard, the chief of the French military aerostatic department, has devised a new type of marine boiler. For some years past this officer has been engaged in the designing of a specially light yet powerful motor for aerial purposes, and it was in the course of these experiments that he has designed this marine boiler. Col. Renard has laid it down as an axiom that the true solution of the problem of aerial navigation depends upon the construction of a motor which shall not weigh more than one kilogramme per horse-power. Although he has not yet succeeded in building an explosion motor conforming with this condition, he has succeeded in designing a steam engine, the weight of which he has reduced to 1.5 kilogramme per horse-power. The particulars of the boiler are preserved a secret by the French government, which has procured the invention and is now developing it, since it means an economy of 75 per cent both in weight and space as compared with the ordinary type of steam generator. Col. Renard has built one of these boilers of 80 horse-power, the weight of which is only 120 kilogrammes, and so satisfactory has it proved under test, that he is now engaged in the construction of two marine engines, one of 1,000 horse-power and the other of 1,200 horse-power, weighing 1,500 and 1,800 kilogrammes respectively, for trials in torpedo boats. Another advantage of this type of boiler is the economy in the consumption of fuel. Gasoline is used at the rate of only 434 grammes per horse-power hour. Steam is raised in seven minutes, and full pressure in fifteen minutes, while scarcely any heat is lost by radiation.

New Method of Manufacturing Steel.

It is reported that successful experiments have just been made by the Iron, Steel and Metals Manufacturing Company at Melbourne, Victoria, for the purpose of proving the value of certain patent rights for the direct production of wrought iron and steel without first producing pig iron. Only a rough idea of the process may at present be had, though trial runs with New Zealand magnetic iron sand are now being made on a somewhat larger scale than hitherto. The sand is first separated from its gangue by electro-magnetic separators, this treatment leaving a pure magnetic iron oxide. The sand is then fed from a bin into the furnace, which is entirely novel in its features, being chiefly mechanical and automatic in its operation.

The ore drops from the bin into a slowly revolving cylinder placed at such an angle that the ore travels forward continuously in it. As it does so it is heated to a dull red by the waste gases from subsequent operations. From this cylinder the ore drops into a second revolving cylinder, where the fine particles are subjected to the action of reducing gases which reduce the magnetic oxide of iron to the metallic form, at the same time permitting the particles to retain their individuality. From this second cylinder the reduced ore drops into a smelting bath at the bottom of the revolving cylinders, and the molten steel or malleable iron, as the case may be, is tapped from this whenever that operation is necessary. It will thus be realized that the process is one of great simplicity and yet of much ingenuity. Not the least interesting part of it is the use of fuel oil for heating purposes. This is employed to secure concentration of heat and direct application in the furnace work. It is found that the fuel oil possesses many advantages over producer gas as used in existing smelting practice. The work done so far has demonstrated that not only is oil a cheap fuel, quite irrespective of the capital outlay that would be required if it was decided to utilize producer gas, but it is so thoroughly under control as to insure the best service.

The temperature at which iron ore melts is given variously at from 1,500 deg. to 2,000 deg. C., according to its purity.

The accurate gaging of temperature in the furnaces plays a very important part in the company's work, and accordingly an installation of thermo-electric thermometers has been made at the company's works. The apparatus consists of a "couple" consisting of a platinum-iridium junction inclosed in a metal tube fully 3 feet long, which is placed in the center of the furnace, and the temperature is then recorded on the dial of a special form of voltmeter, each division on which represents 25 deg. C. This voltmeter reads up to 1,600 deg. and is placed at any convenient distance from the furnaces. The various thermometers are connected with a switchboard, which is again connected with the "couples" or tubes in the furnace. In the installation under notice four "couples" will be used, inserted in different parts of the furnace, and separately connected with the board, so that the reading of any thermometer can be taken and any discrepancy in the heat of different points of the furnace can be quickly remedied. It is interesting to notice that the voltmeter is so extremely sensitive that variations of heat down to 0.5 of a degree were easily noticeable in the trial test. The greatest temperature recorded was 1,300 deg. C., equal to 2,340 deg. F. —John P. Bray, Consul-General.

A direct railway between Shanghai and Canton presented so many difficulties, on account of the mountainous region to be traversed, that some Belgian engineers conceived the idea of making a branch from Shanghai, by Hangeschan and Nantschan, to Tschanscha, capital of Hunan, where it will join the Canton and Hankow line. The Frankfürter Zeitung states that the concession is granted.

The Great Northern Railway has now fitted five sets of Ransomes and Rapier's hydraulic buffers at its King's Cross Station. These buffers, together with five similar sets just installed by the Caledonian Railway at the Central Station, Glasgow, are the largest of their kind yet constructed; their pistons have a stroke of 7 feet. In tests carried out at King's Cross a train, weighing with engine 369 tons, was run into one of these sets of buffers at a speed of 9.4 miles an hour, and by their action was smoothly brought up without serious inconvenience to people seated in the carriages.

THE REINDEER INDUSTRY IN ALASKA.

BY R. I. GEARE.

Uncle Sam has found a very economical and successful way of sustaining life among the Alaskan Eskimos. About a dollar and a quarter a year *per caput* pays the bills, the "value received" consisting of reindeer, imported from Siberia, which furnish the natives with food, clothing, means of transportation, and other necessaries of life.

It will be remembered that Dr. Sheldon Jackson, the Alaskan agent of the Bureau of Education, discovered as far back as 1890 that these people were rapidly losing the sources of their food supply. The whales were going further and further northward, the walruses were disappearing, the seals were becoming exterminated, and even the caribou had departed. In other words, the Eskimos of that region were face to face with starvation.

The result was that in the following year (1901) Dr. Jackson brought over from Siberia the first lot of reindeer, only sixteen, and started a little colony of them on Unalaska, an island lying off the bleak coast of Alaska.

At first the experiment was looked on as rather a waste of time and money, but time came to the rescue, and it was clearly proved that these animals could be successfully imported and taken care of, so that now our good law-makers are appropriating $25,000 annually for increasing the supply. The reindeer have taken kindly to the native moss, which forms their principal article of food and of course needs no outlay for cultivation. There is said to be enough of this moss in Alaska to furnish plenty of food for 10,000,000 reindeer.

The first lot of reindeer imported were selected from the Chukches herds, a tough and hardy breed. Next, some of the Tunguse stock, larger and stronger than the others, were brought over. The price of the former in Siberia is about $4 for a full-grown animal, and of the latter about $7.50 apiece.

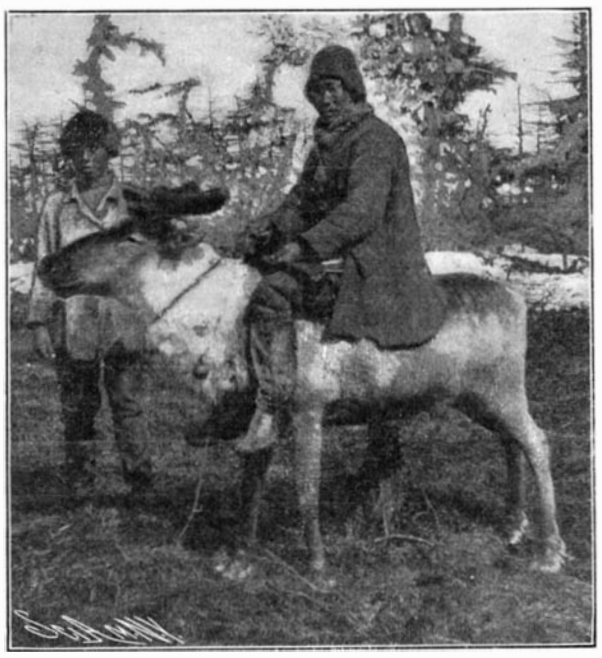
At the present rate of increase, even if no more are imported, there will be at least 1,000,000 reindeer in Alaska in less than twenty-five years. To go a step further, it will not be at all surprising, in the opinion of some, if this industry should grow to be one of considerable commercial importance to the United States, and it has even been estimated that in some thirty-five years Alaska may be in a position to sell annually half a million to a million reindeer carcasses, besides furnishing several thousand tons of hams and tongues. Nor may it be a figment of the brain to predict that at no very distant day, as suggested by Mr. Grosvenor, long trains from Arctic and sub-Arctic Alaska will roll into Seattle and some of our other westernmost cities, laden with cargoes of this very palatable food.

The profits that can be realized from reindeer are, if correctly quoted, very large. For instance, a fawn during the first four years of its life costs the owner less than a dollar a year, while at the end of that period it is worth $50 to $100 for its meat, and nearly double that amount if trained for the sled or as a pack animal.

The does are very prolific, and after the year may be counted on to add to the herd a fawn a year for some ten years. They also furnish very rich milk, which is said to make excellent cheese, the quantity of milk averaging about a teacupful at a milking.

The reliability and endurance of these animals is remarkable, making them invaluable for transportation service. This is proved by the fact that they have now for several years been used to carry the United States mails on regular routes with the greatest success and in about half the time required for dog teams. They can also be ridden with a saddle, and travel along contentedly with a pack-load of 150 pounds.

Thus, while the original motive in bringing these reindeer into Alaska was simply to give the natives a permanent food supply, their excellent adaptation to transportation purposes (especially in view of the discovery of large gold deposits on the streams of those distant Arctic and sub-Arctic regions), has caused them to become an actual necessity for the white man as well as for the Eskimo.



REINDEER RIDING.

These highly successful experiments with Siberian reindeer, it may be added, must not be confounded with the unsuccessful attempt in 1898 to introduce reindeer from Lapland. On that occasion the motive was for hauling supplies from the head of Lynn Canal to miners in the Yukon. The failure in that case was due to the fact that the supply of Norway moss which had been brought with the animals soon became exhausted and the animals positively refused to eat the grass that grew around Seattle. The result was that about three-fifths of them died from starvation, while the remainder were unfit for service. Fortunately for the miners, however, abundant supplies reached them in time to save their lives.

The illustrations accompanying this article are reproduced from photographs, taken by Dr. Sheldon Jackson, in the Smithsonian Institution's reprint of Mr. Grosvenor's article.

A HERD OF REINDEER IN ALASKA.

HOBBLED REINDEER READY FOR SHIPMENT FROM SIBERIA.

No More Crisp Bank Notes.

The days of the crisp bank-note are numbered. Instead of being crisp, the money which the government Bureau of Engraving and Printing will hereafter turn out will be soft and velvety, if important experiments which are now being conducted in the presence of treasury officials for the purpose of demonstrating the advantages of a novel chemical treatment for paper prove satisfactory. The result of the adoption of the new secret process will be to revolutionize a portion of the work connected with the printing of the paper money of the United States. Under the new process it will take just sixty days less time to manufacture a bank-note than under the present method. The chemical solution not only renders the paper soft and velvety, but it also makes it non-shrinkable. By applying it to a Japanese napkin that article becomes as soft and pliable as a tissue of silk. The chemical preparation acts as an antiseptic and preservative. When applied to old documents it seems to knit the fiber together and prevent further decay. Under the present process of printing paper money the paper has to be thoroughly soaked in water. While it is in this soaked condition, one side of the paper is printed. The sheet is then placed in a steam-room and kept under a high temperature for thirty days, the time necessary for the ink to dry. The sheet is again soaked as in the first instance and the reverse side of the bill printed. The thirty-day drying process then has to be repeated. In cases where a third impression on the bill is necessary, which is required when the printing is done in two colors, the wetting and drying process has to be repeated for a third time, and another month is thus consumed in its production. Besides the delay of this process, the wetting and drying rot the fiber of the paper, and, although it is "starched" to give it the crisp appearance, the starch soon wears out and the bill becomes limp and worn. In printing bills on paper that has been treated by the new process no wetting is necessary. The ink loses none of its luster when applied to the paper, as under the old process, and is thoroughly dry within forty-eight hours after the printing is done.—Geyer's Stationer.

The essential features of the wireless system of communication and the automatic fire alarm system have been combined by Emil Guarini, of Brussels, and by means of the apparatus devised by him the heat generated by a fire will itself be the means of giving the alarm to the fire department or wherever else it may be desired. The inventor contemplates that the most valuable function of the system will be the dispensing with the extensive wiring of large buildings where the automatic fire alarm is desired and the method of procedure deemed the most desirable by him is to have the alarm turned in by wireless communication to some central point in the building where there would be some one to receive the alarm and to make an immediate investigation. If necessary, an alarm may then be turned into the fire headquarters by similar wireless methods.

RECENTLY PATENTED INVENTIONS.

Of General Interest.

COMBINATION-TOOL FOR WATCH-REPAIRING.—M. W. SAYYIDAH, Deepriver, Iowa. In this instance the invention has for its aim the provision of novel details of construction for a tool which affords convenient and reliable means for the setting of roller-jewels in correct positions, and hold cannon-pinions and the hands, large and small, of watches when these are to be cleaned or repaired.

BUCKLE.—J. C. ROSENKRANZ, New York, N. Y. One purpose in this case is to provide a buckle especially adapted for use as a suspender-buckle for the back straps of vests or trowsers or similar purposes and to so pivot the tongue of the buckle upon the frame that a pivot-pin will not be required and further, to effect the pivotal connection between the tongue and frame by loosely clamping one end of the tongue in a depression in the frame, thus rendering the buckle more simple and economic in construction than that shown and described in a former Letters Patent granted to Mr. Rosenkranz.

VENTILATOR.—F. J. PROCHASKA, Park River, N. D. The object in this invention is to provide an improvement whereby the top of the ventilator may be raised to any desired distance from the body, so as to increase the efficiency of the ventilator, and, further, to so construct the ventilator that no matter how high it may be placed the said top may be raised and lowered as far as desirable within the limit of its movement by any person within the room or apartment over which the ventilator may be placed.

KNIFE.—G. C PALMER, Rochester, N. H. This invention relates to improvements in pocket-knives, the object being to provide a knife of novel construction in which the blades when not in use are wholly concealed within the handle, the handle consisting of two sections having hinged connection and movable one section relative to the other.

DRAFT-EQUALIZER.—E. J. D. MILLER, New Rockford, N. D. The improvement relates to means for equalizing the pulling strain on two or more pairs of draft-animals, and has for its object to provide details of construction for draft-equalizer, which are simple, practical, and inexpensive, the improvement being equally well adapted for use as a four-horse, five-horse, six-horse, or eight-horse draft-equalizer and in either application effectively distributing the draft strain upon all the animals employed to pull a load.

APPARATUS FOR DESTROYING INSECTS.—A. L. JONES, Llano, Texas. This invention comprises a wheeled frame carrying a novel form of burner which is adapted to pass over the field between the rows of cotton and to burn and destroy all animal and vegetable life between the cotton-rows. Side shields are provided to protect the cotton itself, and a novel blowing apparatus is arranged to act on the cotton and blow the insects from the same under the machine, where they are immediately destroyed. It is intended especially for destroying boll-weevils.

HORSESHOE.—J. E. HOFFMAN, New York, N. Y. In this case the invention relates to improvements in horseshoes designed particularly to prevent a horse from slipping on ice-covered or slippery pavements, an object being to provide a shoe of this character of simple and inexpensive construction and so arranged that a rubber heel-pad may be used in connection with it.

VAGINAL SYRINGE.—H. T. FOOTE, New Rochelle, N. Y. The invention relates to syringes made of rubber and consisting of a bulb and a spout extending integrally from the bulb. The object is the provision of a syringe arranged to insure a complete closing of the vaginal entrance to allow distention of the vagina with a copious flow of water and without exterior escape of the water, thereby preventing soiling of the user's extremities or the clothing and allowing the use of the syringe in a standing position.

BOOT OR SHOE.—W. CRONER, New York, N. Y. The improvement refers to the construction of the sole portions of boots and shoes; and the purpose of the invention is to provide an elastic medium concealed within the sole which will tend to keep the sole normally flat throughout its length and which will add to the elasticity of the tread, particularly in what is known as "flat-last" shoes.

BOTTLE-PACKING DEVICE.—J. T. CRAW, Jersey City, N. J. The purpose of the invention is to provide a sheet, board, or partition in which bottles can be conveniently and quickly placed in alternately-reversed order, portions of bottles extending above and below the sheet, so that they will be arranged in rows, the bottom of one bottle being adjacent to and practically flush with the stoppered mouth of the next, and to so construct the sheet that bottles are readily seated and removed, and so that they be held in place in the sheet, it being possible to remove a loaded sheet from a case, without danger of any bottle carried thereby leaving its position.

MAIL-DELIVERY BOX.—J. A. BARCLAY, Ballena, Cal. The object in this instance is to provide a box having details of construction that adapt it for the safe holding of mail-matter placed therein, that will sound an alarm when the box is opened to deposit mail or notify the owner if an attempt is made to surreptitiously remove the contents, a further object being to provide means for supporting and displaying mail-matter that is to be collected by the authorized collector.

Heating and Lighting.

HEATING-DRUM.—M. E. LOEHR, Claypool, Ind. This invention relates to a drum adapted to be interposed between two stove-pipe sections or, if desired, attached directly to the outlet-flue of a stove, so that the burning gases in passing through the drum will heat the air-compartments thereof and the air circulating through these compartments will in turn be heated thereby.

BURNER.—J. HEINRICHS, New York, N. Y. In this patent the invention relates to a burner for volatile combustible liquids, notably for alcohol. The object is to increase the heat of the burner with a given amount of fuel and to provide a burner which will operate from generated gas with perfect safety and which may be regulated easily and effectively.

Machines and Mechanical Devices.

MORTISING-MACHINE.—G. A. ENSIGN, Defiance, Ohio. Mr. Ensign's object is to provide a mortising-machine arranged to permit of setting the machine to accurately form the mortise to any desired depth, and cause the mortising-tool to operate automatically and feed at a slow speed into the work and return with a fast positive motion during about one-half of the return stroke, to finish the latter under acquired momentum, and to finally come automatically to a stop at the end of the return stroke to allow convenient shifting of the work by the operator for the next cut.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 5880.—For manufacturers of miniature steam tugs or lighters, also for makers of miniature search lights.

AUTOS.—Duryea Power Co., Reading, Pa.

Inquiry No. 5881.—For dealers in shells, etc.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 5882.—For makers of steam engines, boilers and fittings for motor cars up to 6 h. p.; also of running gears for cars suitable for steam engines.

For bridge erecting engines. J. S. Mundy, Newark, N. J.

Inquiry No. 5883.—For manufacturers of windmills, pumps and tanks.

Perforated Metals, Harrington & King Perforating Co., Chicago.

Inquiry No. 5884.—For a 30-h. p. and an irrigating machine moved by the current of a river, also steam return traps for bringing the steam back to the boiler.

If it is a paper tube we can supply it. Textile Tube Company, Fall River, Mass.

Inquiry No. 5885.—For manufacturers of felt, also of springs and spring motors.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 5886.—For makers of cheap perforated lockets for putting up solid perfume.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company Foot of East 138th Street, New York.

Inquiry No. 5887.—For patterns of small gasoline engines, also drawings of small launches.

Woven wire fence machine, makes 1,000 rods daily, easy. Part interest for sale. Price low. W. Z., 1000 Tribune Building, Chicago.

Inquiry No. 5888.—Wanted, information concerning machinery and methods of pressing dry powder into cakes, wrapping same in paper wrappers and pasting same together.

Patented inventions of brass, bronze, composition or aluminum construction placed on market. Write to American Brass Foundry Co., Hyde Park, Mass.

Inquiry No. 5889.—Wanted, to communicate with users of infusorial earth.

Sheet metal, any kind, cut, formed any shape. Die making, wire forming, embossing, lettering, stamping, punching. Metal Stamping Co., Niagara Falls, N. Y.

Inquiry No. 5890.—For makers of hanking machines for putting up fish lines.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 5891.—For machinery for making 2 x 4 x 8 inch concrete brick (sand and cement).

English and European Market for American Manufactures.—W. & R. Leggott, Limited, East Parade, Bradford, England, is in remarkably good position for handling any article connected with building trade, and will be glad to act as agent for American firms. Please communicate.

Inquiry No. 5892.—For makers of windmills used for pumping water for irrigation purposes.

MECHANIC, first-class workman, teetotaler, having thorough knowledge (both theoretical and shopwork) of manufacturing watchmakers' tools, instruments for dentists, physical and electrical apparatus, induction coils, Roentgen apparatus, etc., and most other branches of mechanical work, wants employment. Write to T. REUTER, 247 Avenue A (Mueller), N. Y. City.

Inquiry No. 5893.—For makers of novelties for the mail order business.

Inquiry No. 5894.—For makers of high power, light-weight engines, of about ½ to 2 h. p., not to exceed 75 pounds.

Inquiry No. 5895.—For manufacturers of balloons.

Inquiry No. 5896.—For an overshot water wheel, used for small power on farms, made of steel, axle rams, etc., bucket of sheet iron, etc.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9443) W. H. asks: 1. Please explain the principle of the string telephone and how it works. A. The diaphragm of the string telephone vibrates and transmits the vibrations of the air set up by the voice to the string. This in turn transmits the same vibrations to the diaphragm at the other end of the line and this in turn sets the air in vibration at the other end of the line. So the ear at the receiver hears that which is spoken into the transmitter at the remote end of the line. 2. If talking in a room causes the walls of the same to vibrate. A. The walls of a room certainly vibrate when a sound is made in the room. To see this, place your ear against the wall when a piano is being played on the other side of the wall. You will hear the tone of the instrument very much louder. 3. Is it the north or the south pole of the compass needle that points to the north? A. The north pole of a magnet is the pole which points north when the magnet is at rest under the action of the earth alone. 4. When a bar magnet has one of its poles stamped with "N" does it mean that it is a north pole or a north-seeking pole? A. The pole marked "N" and the north-seeking pole are the same poles. These are two different names for the same thing. There is no need of the name "north-seeking." It is of course true that the nature of the magnetism in the pole of the magnet is opposite to that of the pole of the earth toward which the magnet points; but this is not involved in the name of the pole of the magnet. The north pole of a magnet is the pole which points north, and the north-seeking pole is the same. Neither name expresses the nature of the magnetism of the earth at its north pole.

(9444) W. S. B. asks: Is it necessary in order to produce a current in a wire by induction, that the wire should be cut by magnetic lines of force? If so, how can the secondary wire of an induction coil or of a transformer be cut by lines of force when only a direct current is sent through the primary? A. It is necessary that a moving conductor should cut lines of magnetic force in order that an E. M. F. should be produced in that conductor. Then a current will flow through the moving conductor if the external circuit be closed. This is the basis for the production of electric currents by dynamos. It is necessary that the number of lines of force which are included in the turns of a closed conductor which is at rest should vary in order to produce an E. M. F. and current in that conductor. In this way currents are produced in induction coils which are a special form of transformers. A direct current is sent into the primary coil. While this current is rising to its full flow, the number of lines of force in the space in and around the induction coil is increasing, and a secondary current is produced in the secondary coil in the reverse direction to that of the inducing current in the primary coil. A secondary current is also produced in the turns of the primary coil in the reverse direction to that of the primary which cuts down the effect of the induction of the primary current. This is called self-induction. As soon as the primary current reaches its full value, if it is direct, the induction ceases and no further change takes place in the number of lines of force in the secondary. Hence the secondary current ceases. At this instant the vibrator, or other form of interrupter, breaks the primary circuit, and the lines of force in the space around the primary coil fall back to zero. This in the same manner as before produces an E. M. F. and current in the secondary and primary also, but in the same direction as the flow of the primary current. This action constantly repeated and combined with the action of the condenser gives a succession of sparks at the spark gap of the secondary coil. The condenser causes that the sparks shall take place only upon the break of the primary circuit and shall the refore be all in the same direction as that of the primary current. In this way the common forms of induction coil give a pulsatory, interrupted, unidirectional current. For fuller explanation of this see "Thompson's Elementary Lessons," which we can send you for $1.40.

NEW BOOKS, ETC.

RADIO-ACTIVITY. By E. Rutherford, D.Sc., F.R.S., F.R.S.C. New York: The Macmillan Company, 1904. 8vo.; pp. 399. Price $3.50.

Prof. Rutherford, who occupies the chair of physics at McGill University, Montreal, has been one of the most prominent experimenters in the field of which his new book treats. Since the discovery of radium, every day new experiments are being made to determine the radio-activity of various substances, and the probabilities are that its phenomena will yet cause a complete revision of our ideas concerning matter. Throughout his work Prof. Rutherford has followed the theory that the atoms of radio-active bodies are undergoing spontaneous disintegration. The interpretation of results obtained has been largely based on this theory, and the logical deductions made from its application to radio-active phenomena have also been considered. The work covers the whole subject in a comprehensive manner. Besides chapters on radio-active substances and emanations, as well as on the radio-activity of the atmosphere and of ordinary materials, the nature, properties, and measurement of the radiations and emanations are treated of in a most thorough manner. A chapter on the "Ionization Theory of Gases" will be found very helpful in the interpretation of the results of measurements in radio-activity by the electric method, while another short chapter describes the methods of measurement which give the most accurate results. The book will without doubt receive a cordial welcome from all physicists and experimenters throughout the world.

SEA GUIDE AND YACHTING MANUAL FOR 1904. By Paul Eva Stevenson. New York: Gardner & Cox, 1904. Price, 25 cents.

This little book contains a good deal of information of interest and value to yachtsmen and sailors in general. Among these topics may be especially mentioned the comprehensive tide tables on page 2 and explanation of the United States Buoyage System on page 145. There is in short a very fair collection of data relating to things encountered by the yachtsman cruising either at home or abroad.

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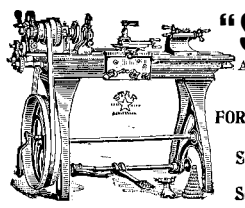

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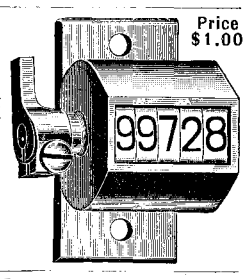

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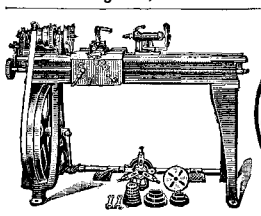

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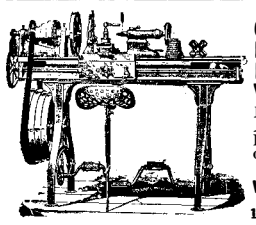

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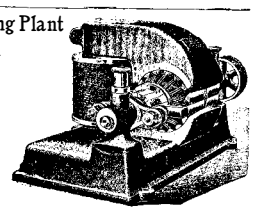

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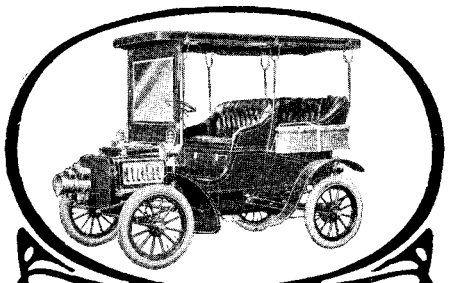

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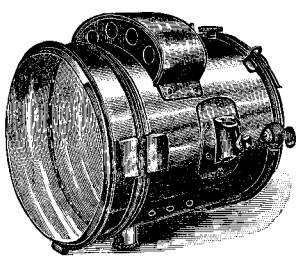

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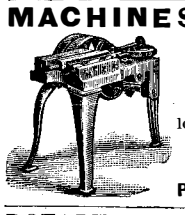

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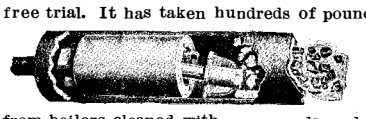

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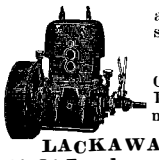

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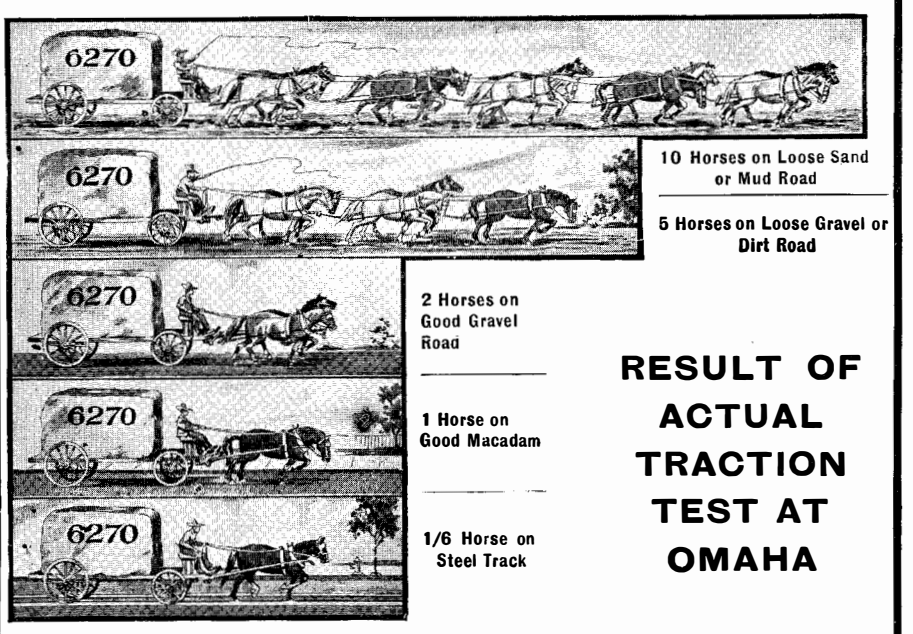

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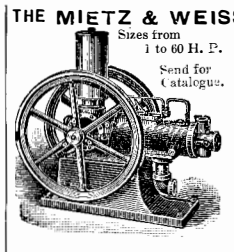

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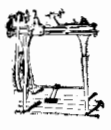

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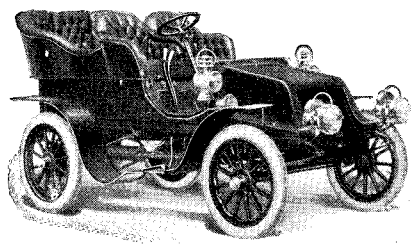

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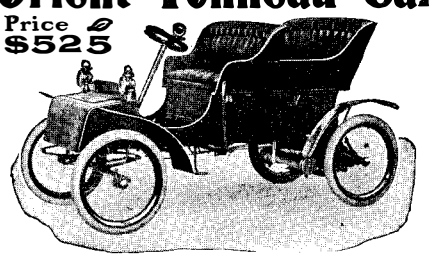

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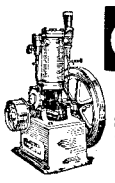

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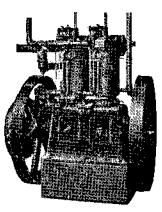

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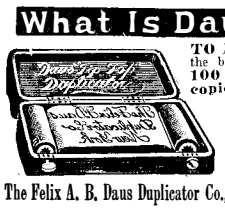

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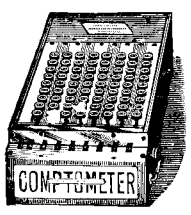

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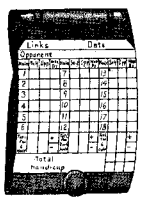

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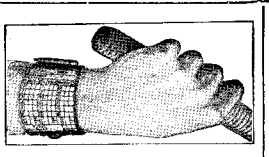

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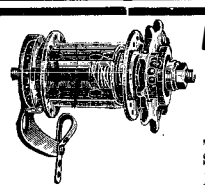

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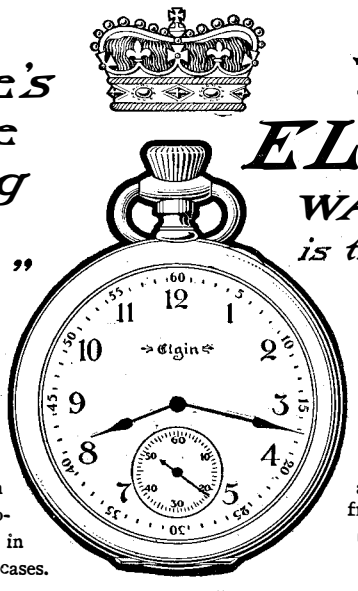

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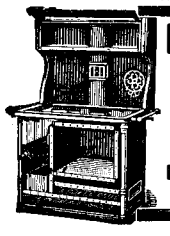

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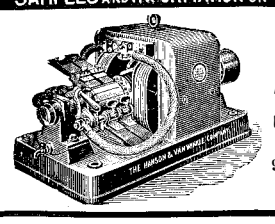

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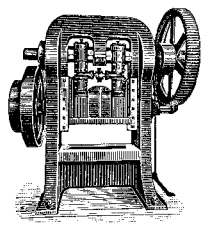

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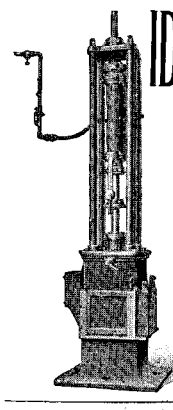

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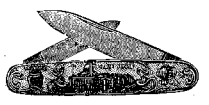

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